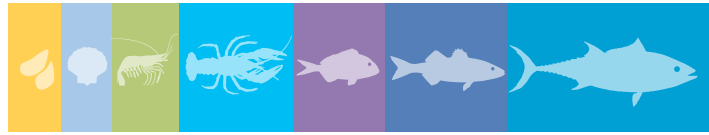




Food and Agriculture
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FAO Aquaculture News



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The times they are a-changin'...

Dear reader,

In 2020, the Fisheries and Aquaculture Department of FAO underwent a significant re-structuring, following the abolishment of the Assistant Director-General position and its associated office. Fisheries and aquaculture activities now fall under the 'Fisheries Division', but do not get too familiar with this name as it is likely to change very soon! Indeed, Members have requested FAO to reinsert 'aquaculture' in the name of the Division to acknowledge the global and rising importance of the sector. The previous six 'Branches' have now moved towards a flatter structure with three new thematic areas – Sustainable Aquaculture, Sustainable Fisheries, and Sustainable Trade and Value Chains – with several teams in each thematic area. With this new structure, we raise the profile of aquaculture, empower more staff, and consolidate in-house knowledge and expertise under the leadership of a Deputy Director, with three teams falling under the Sustainable Aquaculture theme: (i) Global and Regional Processes, (ii) National Planning and Development Support, and (iii) Technology and Production (see diagram). In addition, the new structure includes four cross-cutting teams: i) Information and knowledge management, ii) Resilience, iii) Gender and iv) Statistics. In many ways,

2021 will be a year of transition, and as we implement the new structure we hope that *Aquaculture* in FAO will be a stronger, more active and more responsive unit, better positioned to support aquaculture development worldwide recognizing its increasingly important role in the context of sustainable food systems.

Moving on to important events in 2021: Together with our partner the Network of Aquaculture Centres in Asia-Pacific and our host the Chinese Ministry of Agriculture and Rural Affairs, we are on track to convene the hybrid Global Conference on Aquaculture Millennium +20 in September this year. As of May 2021, we have close to 1 600 registered participants, with more than half falling in the 'youth' category, and about 800 international participants wishing to attend in person. With participation spanning the globe and interpretation provided in all six UN languages, we are confident that the Arabic-, Chinese-, English-, French-, Russian-, and Spanish-speaking aquaculture enthusiasts and stakeholders as well as all those wishing to make sustainable aquaculture part of the food system transformation, can look forward to an exciting event. Make sure to read the update on page 5 to familiarize yourself with the programme, poster contest and other latest news.

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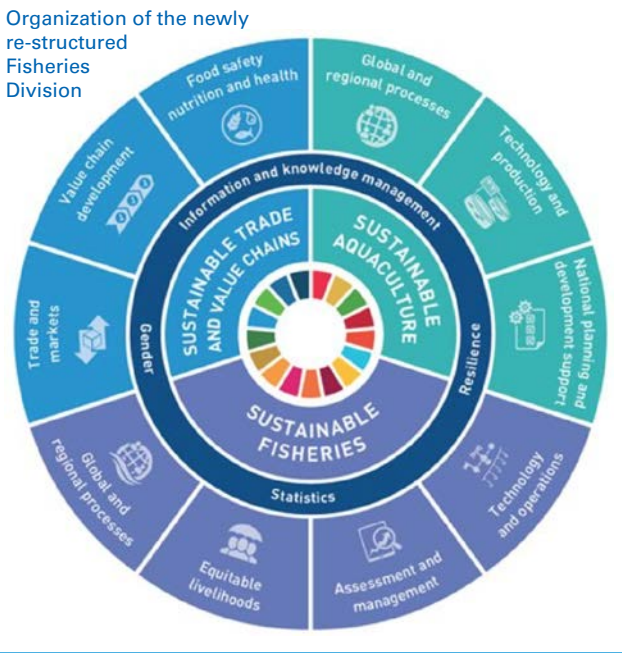
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COVER PHOTOS:

Top photo: Marisol Churacutipa, Head of Production at Truchas Arapa, rows among the fish cages in Lake Arapa, Peru. ©FAO/Jordi Vaqué.

Bottom photo left: Seamoss (*Kappaphycus alvarezii*) seen here in St Kitts and Nevis, is an important aquatic product for people across the Caribbean, often processed into a health food drink. ©FAO/Austin Stankus.

Bottom photo right: Technicians feed orange-spotted grouper or Hamour breeders at a fish farm in the United Arab Emirates. ©FameMedia.



One of the changes the COVID-19 pandemic has brought about is that colleagues in FAO have been working from their 'home office' for well over a year, with many virtual meetings and events. See the article in this FAN on some of the pros and cons of virtual meetings, as well as articles about COVID-19 impacts in China, and how the pandemic has affected the fisheries and aquaculture sector in the Maghreb. Be sure to see also the Publications section and the back cover for links to all FAO resources relating to COVID-19.

Finally, the departure of Valerio Crespi after issue 59 brought an end to his excellent work and accomplishments as FAN Chief Editor. The past three issues of FAN were published under the responsibility of two Managing Editors, with Lionel Dabbadie and Austin Stankus coordinating and managing all activities, workflows and timelines for issues 60 and 61/62, respectively. Along with these changing times, FAN now becomes the FAO Aquaculture News (more on this in the next edition). It is my great pleasure to announce that along with the new name of FAN, the Editorial Board has elected Austin Stankus as the new Chief Editor – warm congratulations Austin!

In this issue, we again compiled many interesting articles, from the various updates on global and regional consultations to thematic articles on conservation, aquaparks and gender in aquaculture. The development of Guidelines for Sustainable Aquaculture and the Global Plan of Action on Aquatic Genetic Resources are major new and exciting workstreams in our Sustainable Aquaculture theme that you may wish to read up on. And we hope that the 'regular' five-year interval reporting on regional status and trends in aquaculture provides you with the necessary facts and figures for better information and planning.

Happy reading, and please stay safe!

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©FAO/W. Crespi (photo taken before COVID-19 pandemic)

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Global Aquaculture Updates



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Global Conference on Aquaculture Millennium +20: Updates

Preparations towards the Global Conference on Aquaculture Millennium +20 (GCA +20) in Shanghai, China, are well underway, and the GCA +20 Secretariat is pleased to share the most recent updates. First, registration is now open, and participation is free of charge. Already over 1 500 people have registered – be sure to visit the [GCA +20 website](#) to apply!

As an important change, the GCA +20 will be a hybrid conference, with a limited number of speakers and participants attending in person, and the rest attending virtually. While we would prefer to greet everyone in Shanghai in person, the ongoing COVID-19 pandemic and associated uncertainties over travel restrictions have urged a precautionary approach, and we therefore expect a reduced capacity to host presential participants. On the positive side, a hybrid structure will allow more people to attend, albeit virtually, thereby opening participation to all stakeholders, many of whom would not have had the time or resources to travel. Another positive development is that the entire GCA +20 will have simultaneous interpretation in the six United Nations languages: Arabic, Chinese, English, French, Russian and Spanish. Partner institutions have provided translations of the website, and the GCA +20 Secretariat gratefully acknowledges the contributions of all those involved, namely, the Network of Aquaculture Centers in Central Eastern Europe, Shanghai Ocean University, the Aquaculture Network of Africa, and the Central America Fisheries and Aquaculture Organization (Organización del Sector Pesquero y Acuícola del Istmo Centroamericano).

Programme

The International Programme Committee has prepared a preliminary programme, but be sure to check the GCA +20 website as keynote speakers, workshop information and other updates are announced.

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DAY 1: Thursday, 23 September			
Morning session	Opening speeches, ceremony and official welcome <ul style="list-style-type: none"> - Ministry of Agriculture and Rural Affairs, People's Republic of China - Network of Aquaculture Centres in Asia-Pacific - Food and Agriculture Organization of the United Nations 		
	Keynote presentations (TBC) <ul style="list-style-type: none"> - The Role of Aquaculture in Food Systems 2050 - Green Development and Fisheries Future - The Shanghai Declaration 		
Afternoon session	World Aquaculture 2020: A brief overview <ul style="list-style-type: none"> - Global Synthesis of the State of World Aquaculture 		
	Regional reviews on status and trends in aquaculture development <ul style="list-style-type: none"> - Asia and the Pacific - Europe - Latin America and the Caribbean - Near East and North Africa - North America - Sub-Saharan Africa 		
Evening session	Special topic presentation <ul style="list-style-type: none"> - Aquaculture investment (TBC) 		
	Poster session <ul style="list-style-type: none"> - Emerging issues and research relevant to conference themes 		
DAY 2: Friday, 24 September			
	Stream 1	Stream 2	Stream 3
Session I	Aquaculture systems	Aquaculture feed and feeding	Aquaculture policies, planning and sectoral governance
Session II	Aquaculture innovation and technical solutions	Aquatic genetic resources and seed supply	Social and human dimensions of aquaculture
Session III	Transforming aquaculture to achieve the Sustainable Development Goals	Biosecurity and aquatic animal health management	Value chains and market access for aquaculture products
Session IV	Workshop (TBA)	Workshop (TBA)	Workshop (TBA)
DAY 3: Saturday, 25 September			
Morning session	Two special topic presentations (TBA)		
	Thematic session summaries		
	Presentation <ul style="list-style-type: none"> - Student poster competition winners 		
Afternoon session	Adoption of the Shanghai Declaration		
	Official closing		

Regional reviews

A major component of the GCA +20 is the preparation of the Regional Reviews of Aquaculture and the *State of World Aquaculture 2020*, which will be presented and discussed on the first day of the GCA +20. FAO organized a series of webinars in October 2020 (during the original dates of the GCA +20) to present the initial findings of these Regional Reviews. Summaries of these webinars can be found in this edition of *FAN*, and the full recordings are available on our website.

Thematic reviews

Under the guidance of the International Programme Committee, groups of subject experts are currently drafting nine Thematic Reviews of Aquaculture. The reviews cover a full range of key issues impacting the future of aquaculture, and will be presented and discussed during Sessions I–III on the second day of the GCA +20 (see the programme above). The draft Thematic Reviews will also be made available for comment by registered participants, with advanced drafts posted on our website. Received comments, along with the discussion during the GCA +20, will be considered in the finalization of the Thematic Reviews.

Shanghai Declaration

The Shanghai Declaration, a key output from the GCA +20, will represent a road map to optimize the role that aquaculture can play in achieving the 2030 Agenda for Sustainable Development. A group of aquaculture experts has prepared a first draft, and a similar commenting process will be available to registered participants. We expect that a penultimate draft will be ready during the weeks prior to the GCA +20, with the final text adopted on the final day.

Posters

To encourage active participation, especially of youth, students and early career researchers and aquaculturists, the GCA +20 will include a poster session and a youth poster competition. Accepted posters will be displayed online. All registered participants are invited to submit a poster abstract. A limited funding opportunity based on the quality of the poster abstracts was also made available to facilitate in person participation of youth from developing countries.

Link to global processes

The GCA +20 comes at an important time, and there are strong connections to several important events. The 34th Session of the Committee on Fisheries (COFI) welcomed the holding of the GCA +20 and encouraged all Members to participate. As part of the Written Correspondence

Procedure, many Members and Observers indicated their strong support for the GCA +20, noting its timely nature and a desire that interested stakeholders are involved in the preparation of the Thematic Reviews and the Shanghai Declaration. The written statements and the Secretariat response can be found on the COFI website.¹ In response, the outputs of the GCA +20 will be made available for consideration during the next session of the COFI Subcommittee on Aquaculture, to be held in Mérida, Mexico, from 15 to 18 November 2021.

Additionally, the Secretary-General of the United Nations will convene a 2021 Food Systems Summit as part of the Decade of Action to achieve the Sustainable Development Goals (SDGs) by 2030. The Summit will launch bold new actions to deliver progress on all 17 SDGs, each of which relies to some degree on healthier, more sustainable and equitable food systems. As food systems touch every aspect of human existence, the health of our food systems profoundly affects the health of our bodies as well as the health of our environment, our economies and our cultures.

Furthermore, the General Assembly of the United Nations proclaimed 2022 as the International Year of Artisanal Fisheries and Aquaculture (IYAFA), with FAO serving as the lead agency. IYAFA will enhance global awareness about, understanding of, and action to support the contribution of small-scale artisanal fisheries and aquaculture to sustainable development, and more specifically in relation to food security and nutrition, poverty eradication and the use of natural resources. IYAFA will promote dialogue and collaboration between and among small-scale artisanal fishers, fish farmers, fish workers, governments and other key partners along the value chain, and further strengthen their capacity to enhance sustainability in fisheries and aquaculture.

We know that we all must work together to transform the ways the world produces, consumes and thinks about food. With aquaculture increasingly recognized for the essential food production sector it is, the GCA +20 will have a critical role in aligning the future path of aquaculture with the development trajectory needed to contribute effectively to the achievement of the SDGs and a world without hunger.

SEE ALSO

GCA +20 website: www.aquaculture2020.org

United Nations Food Systems Summit 2021:
www.un.org/en/food-systems-summit

International Year of Artisanal Fisheries and Aquaculture 2022:
www.fao.org/artisanal-fisheries-aquaculture-2022

1. See www.fao.org/about/meetings/cofi/wcp-cofi34/comments-agenda5/en/

Regional Consultation Workshops on the Development of a Global Information System on Farmed Types of Aquatic Genetic Resources and the “New Normal” of the Virtual Workshop Environment

Introduction

We have reported previously on a Regional Workshop for the African Region on the “Development of a global information system for farmed types of aquatic genetic resources” held in Addis Ababa, Ethiopia, in December 2019, prior to the COVID-19 pandemic. This workshop was intended to be the first of a series of regional face-to-face workshops, a modality and working environment in which FAO is well practiced. However, the pandemic arrived and after originally postponing the planned workshops we recognized that, if we were to move forward with the development of these important information resources in support of the improved management of aquatic genetic resources (AqGR), we had to run the remaining workshops in a virtual modality. Four such workshops were thus organized to ensure that we consulted fully with the remaining FAO regions, as follows:

- Asia and the Pacific (8–12 June 2020);
- Latin America and the Caribbean and North America (21–24 September 2020, in English and Spanish);
- Europe and Central Asia (5–8 October 2020, in English and Russian);
- Near East and North Africa (abridged version, 7–8 December 2020, in English and Arabic).

The last workshop for the Near East and North Africa was an abridged two-day version of the programme added to the calendar upon the request of the FAO subregional office.

The workshop outcomes

The objectives of these workshops were the same as for the African regional workshop reported previously, aiming to bring together national focal points on AqGR and other relevant regional stakeholders to guide FAO in two major, ongoing areas of work for the promotion of the sustainable use, conservation and development of AqGR in the aquaculture sector. These FAO initiatives, being developed at the request of Members, are: (i) the development of an information system for farmed types of AqGR; and (ii) the development of a draft Global Plan of Action for AqGR. In the first part of the workshop, delegates reviewed the scope and structure of a Registry (the core of the prototype information system) and an associated online questionnaire developed for entering farmed type data into the Registry, and provided regionally relevant feedback. Participants

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FARMED TYPE

A descriptor of aquatic genetic resources below the level of the species. A farmed aquatic organism could be a strain (animals), variety (plants), hybrid, triploid, monosex group, or other genetically altered form, or wild type.

recognized the value of an information system as a tool for characterizing and monitoring their genetic resources and identified the principal stakeholders who can provide data to the system and utilize information from the system. Participants also identified some constraints to data collection, such as the capacity to provide information on the production volume and value of farmed types rather than species, but overall they were broadly supportive of the scope of the information being collected.

The second part of the workshop focused on the Global Plan of Action through working group sessions, which reviewed the strategic priorities under four pre-agreed priority areas (see Figure 1). The working groups proposed some changes in the strategic priorities as they related to each region and provided potential actions and indicators under the priorities. Some regional differences were identified in the workshops, for example Europe and Central Asia identified recreational fishing associations as stakeholders in the information system, a sector not considered in the other regions.

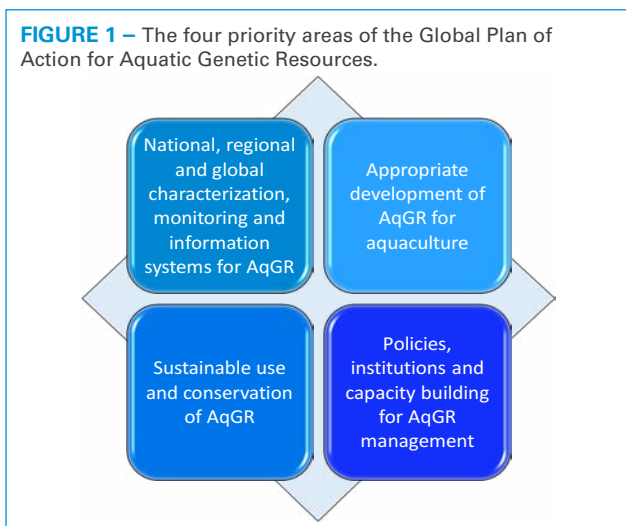
After these workshops ended, some changes were made to the questionnaire used for data collection. FAO is currently drafting the Global Plan of Action with the challenge being to effectively integrate the regional input provided across these five workshops together with input provided by Members in writing.

The workshop format

Twelve months into the pandemic many of us are now very familiar with the virtual meeting environment using one of the many available videoconferencing platforms. However, back in the early months of the pandemic we were very much “learning by doing”. This section of the article highlights some of the issues we encountered in planning and implementing these semi-formal consultation workshops, how we learned from some early mistakes and improved the format over successive workshops, and what we now know about the strengths and weaknesses of the virtual workshop format. These learnings came from our own experiences as organizers and from feedback from post-workshop surveys sent to participants.

1. FAO Aquaculture Newsletter No. 62, October 2020, p. 9 (also available here www.fao.org/3/cb1550en/CB1550EN.pdf).

FIGURE 1 – The four priority areas of the Global Plan of Action for Aquatic Genetic Resources.



We set out with the goal of trying to replicate the experience and achieve the same objectives as we had expected to achieve in a “standard” regional workshop format in which we met, or would have met, with the delegates combining presentations, plenary discussion sessions, and break-out working group sessions over a three-day period. The first decision was that these semi-formal meetings, involving delegates (primarily national focal points appointed as country representatives, but also some other relevant stakeholders) spanning multiple time zones, could not practically be run successively over three full days, as it is difficult to maintain an adequate attention span in a virtual environment, especially if it was expected that delegates in some time zones would have to work outside normal working hours. We settled on a format of 90–120 minute sessions over five days, combining short presentations with discussion sessions. We held a sixth session a week after the final workshop session to discuss and adopt the workshop report. With the overall reduction in contact hours, it was necessary for delegates to prepare for the workshop sessions by reviewing pre-session reading material, which most delegates did. Online quizzes were provided as follow-up exercises to allow delegates to evaluate their comprehension of these reading materials. If sessions ran over 90 minutes, we learned that delegates preferred to have a short five-minute break in the middle of the session.

For the most part, FAO staff did not know the delegates and the delegates did not know each other, but the format did not really permit time for personal introductions, which were instead done within the chat box. Without these introductions and without ice-breaking activities (difficult in a virtual format), it was challenging in the early sessions to generate good constructive dialogue, although this would generally improve over time. However, this phenomenon is not unique and can also happen in face-to-face workshops. It was certainly considered desirable for delegates to use video, especially when speaking, but bandwidth issues made this difficult for many delegates.

The Zoom feature of break-out rooms was used for the working group sessions, with delegates breaking out to the rooms for 50-minute discussion sessions, which were often

too short to complete the assigned tasks; and it was difficult to be flexible with groups who wanted to extend discussions given that the programme required delegates to return to the main room at a set time. As the workshops were regional, interpretation was only required for a maximum of one language. In these cases, the interpretation was manageable within the Zoom format although, for the working group sessions, we were required to group non-English speakers together given that interpretation was not available in the break-out room environment.

The upside and the downside

Overall, we believe that we successfully adapted the virtual format to the target objectives and are comfortable that these workshops achieved their objectives, and this was confirmed by the delegates in the post-workshop survey. The format had its upsides and downsides but, in closing, we wish to highlight one of the major advantages and the major drawback that we recognized with the virtual format. The opportunity presented by the switch to a virtual format was that we could extend the reach of the activity given that we were no longer limited by the budget available for the workshop organization and, in particular, the travel and subsistence costs for the participants. We were thus able to expand the invitations and participation to a broader list of stakeholders and a wider scope of expertise. We achieved this by permitting national focal points (the formal national representatives) to invite up to five additional stakeholders to support them in the workshops. Overall, the attendance at these workshops was at least double what would have been possible in a face-to-face workshop (although, unlike in a face-to-face workshop, the participants and national representation often changed from one day to the next), but despite this the overall costs of the workshops were reduced compared to the cost of running face-to-face workshops.

Although we were able to generate strong interest in follow-up activities from some participants, a major downside of the virtual format was in the relative absence of relationship building through the workshop. In the African regional workshop in Ethiopia, delegates built relationships with each other and with the organizers, made plans for cooperation, and were able to discuss the workshop contents and other issues outside of the immediate environment of the workshop. These interactions often occurred over lunches, coffees, dinners or walks outside the workshop venue. These interactions do not occur in the virtual format, and within the confines of the format we developed, we were not able to find a solution to this dilemma. While we felt that we got to know some of our national focal points and other delegates a little over the five days of the virtual workshop, this was far inferior to the level of familiarity we would be able to achieve in a face-to-face environment. For this latter reason, while virtual workshops will have their place in the “new normal” and will be more commonplace (especially among groups who already know each other), even when the COVID-19 pandemic (hopefully) fades to a painful memory, we do not believe that virtual workshops can ultimately replace the traditional face-to-face workshop in many circumstances.

Regional Consultations on the Development of Guidelines for Sustainable Aquaculture (GSA) for Asia and Latin America

The Guidelines for Sustainable Aquaculture (GSA) were requested by FAO Members at the ninth session of the Committee on Fisheries Sub-Committee on Aquaculture (COFI/AQ), which was held in Rome in October 2017. The aim of the GSA is to provide practical guidance to government authorities and policymakers in their efforts to promote the implementation of the Code of Conduct for Responsible Fisheries (CCRF) and to engage and enable aquaculture to effectively participate in the implementation of the 2030 Agenda for Sustainable Development.

The approach taken by FAO to develop GSA includes extensive and inclusive consultations at global and regional levels as recommended by COFI/AQ Members in 2019. As a series of regional consultations, the first regional consultation on the development of GSA for Africa held in Bamako, Mali from 29-30 November 2019. The second and third virtual regional consultations were held in late November and December 2020 for Asia and Latin America. In succession, the fourth virtual regional consultation for the Caribbean and Pacific Small Island Developing States was held 23-25 February 2021. The participants were invited and/or nominated through the invitation letters initiated by FAO Regional and Subregional Offices sent to countries. Most participants represented governments, with additional participants from academia, Intergovernmental organizations, non-profit organizations, and research institutes. For the Africa region, consultation on GSA was organized back to back with the 18th Session of CIFA; 28 countries attended the in-person consultation. For the Asia region, out of the 26 countries invited, 18 countries attended the virtual-mode consultation. For the Latin America region, out of the 19 countries invited, 13 countries attended the virtual-mode consultation. For the Pacific and the Caribbean, out of the 23 countries invited, 16 countries attended the virtual-mode consultation.

The ongoing regional consultation process aims to:

- 1) share current policies and practices related to aquaculture in the region;
- 2) review existing regional sustainable aquaculture guidance and assess gaps that GSA could address;
- 3) consult on the development process of GSA in the regional perspective, and;

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- 4) discuss potential regional case study concepts based on regional priorities determined by them.

For more background information and the previous African regional consultation on GSA, see the articles in FAN 61 and FAN 62.

The process of regional consultations was preceded by a global expert consultation in June 2019 which identified 72 thematic modules which could be selected as the core of the GSA. They will describe the rationale and attributes for approaches and practices on specific topics, the existing guidelines and the key recommendations for successful implementation and capacity development.

The thematic modules include themes such as Sustainable aquaculture and the 2030 Agenda, Governing and planning aquaculture development, Biodiversity and genetic resources, Better Management Practices in Aquaculture, Sustainable feed, Water management, Biosecurity, aquatic animal health and animal well-being, Specific farming systems, Aquaculture value chains, consumers, markets and trade and Aquaculture statistics and information and will be shaped by making use of the lessons learned from various case studies.

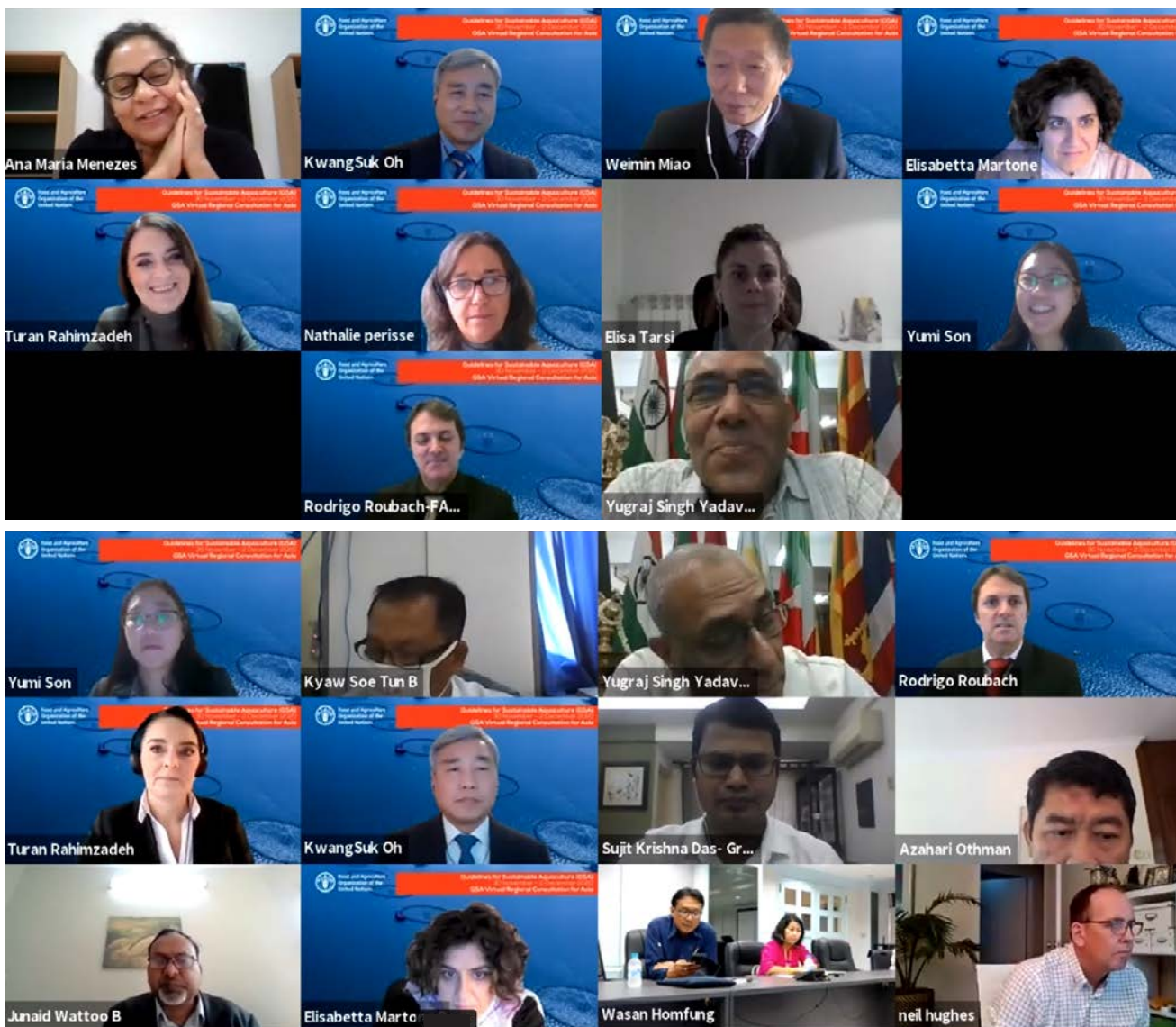
Out of 72 thematic modules, recommendations for editions and adding new modules have been suggested. Asia emphasized the need to add topics on water availability, transboundary movement of aquatic animals, aquatic animal disease surveillance, monitoring and early warning, improving the base and knowledge management importance of youth in aquaculture, and aquaculture leases and permits, water regulation, environmental policy and regulation. In the case of Latin America, participants pointed out the importance of resource use efficiency, human rights related to sustainable feed development, zoning and carrying capacity, family-level aquaculture, raising youth awareness of the value chain of aquaculture production, and capacity building on business management.

During the regional consultations, participants were asked: first to revise and select the case study concepts proposed during the expert consultation in 2019 and the COFI/AQ in 2019; then to propose additional concepts if relevant for their region. Eleven case study concepts were proposed in Africa, 23 in Asia, 55 in Latin America, 25 in the Pacific and the Caribbean. Since the thematic modules composing the GSA will be shaped first by making use of the lessons learned from existing relevant documentation. The case study concepts will be selected only to complement existing gaps, taking into account development status, production levels and systems, including similarities among them and with up to five case

studies per region should be selected for publication. Overall, the past consultations have allowed to find common highlights of demanded thematic areas and case study concepts on gender and youth, public-private partnership, biosecurity, and capacity development of small-scale producers/farmers, feed and food by-product, digitalization and monitoring, data and statistics. To this end, the selected concepts of successful and unsuccessful case studies will be analyzed, and their valuable lessons will be extracted. The Secretariat will apply the criteria agreed during the global expert consultation to select an optimal number of case studies to be developed.

In 2021, the FAO Secretariat will complete the consecutive regional consultations through virtual platform scheduled for the Eastern Europe and Central Asia (29–31 March), Near East and North Africa (6–8 April), and North America and Europe (27–29 April).

Along with conducting a series of consultations and drafting the GSA, the GSA progress report will be prepared and presented at 11th session of the COFI/AQ in Mexico 2021 for sharing the progress and getting advice from the Members. The final GSA draft will be presented during the COFI 35 for Members' review.



Screenshots of the virtual GSA meeting for Asia.

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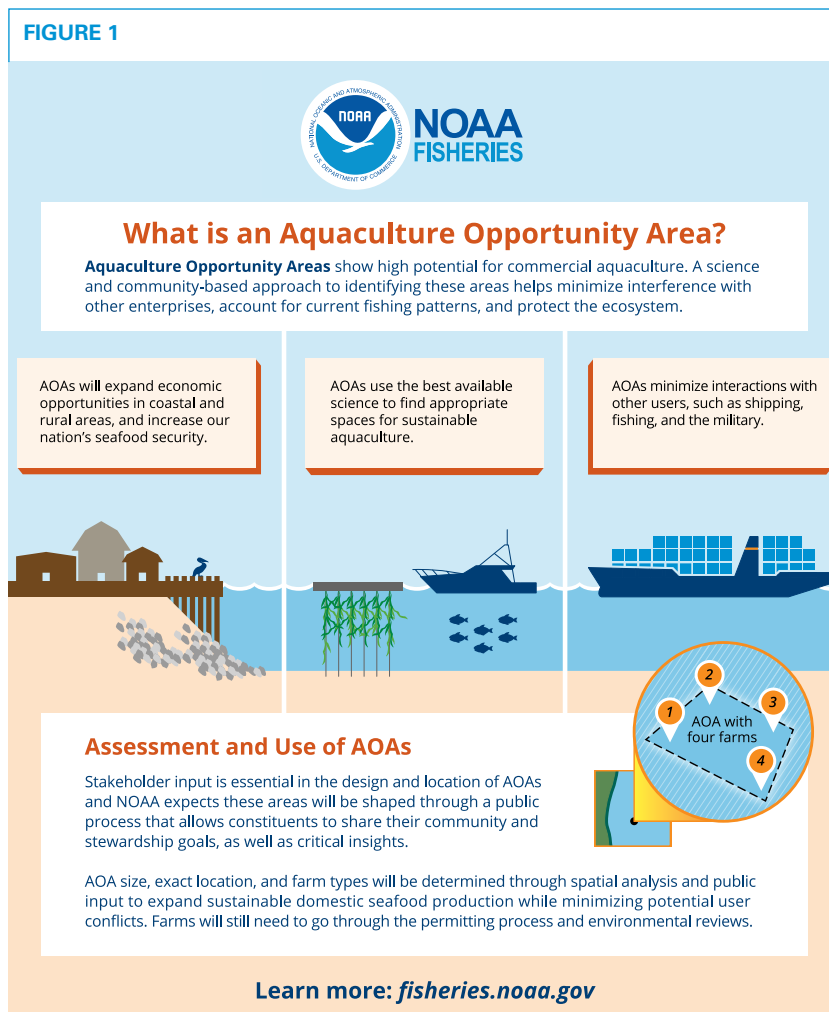
NOAA Develops Aquaculture Opportunity Areas with Insights from FAO and the International Community

According to FAO, the availability of space is one of the key constraints for aquaculture expansion to meet future demand for seafood. For the promotion of sustainable aquaculture in the coming decades, it is imperative to apply effective, integrated spatial planning at both the national and regional levels. This planning facilitates the identification and management of environmentally and socially compatible areas for the sustainable growth of aquaculture. Additionally, a sound, legal regulatory framework enables effective planning, development and management of aquaculture. The framework should ensure that rights, including tenure rights, are secured and that roles and responsibilities of all stakeholders are clearly defined to minimize potential impacts.

The growth of marine aquaculture in the United States of America is a national priority, and this increase in seafood production is critical to the health of people, the health of the planet, and the health of the economy. The identification of Aquaculture Opportunity Areas (AOAs) is one path towards this goal through proactively finding the appropriate space for the sector to develop. AOAs will be distinct geographic areas that have been evaluated for their potential to support multiple sustainable commercial aquaculture farm sites of varying types, including finfish, shellfish and seaweed (Figure 1).

As the United States National Oceanic and Atmospheric Administration (NOAA) works with partners and stakeholders to identify and develop AOAs, it recently drew upon FAO and the international community's aquaculture

FIGURE 1



management knowledge by hosting an Aquaculture Zonal Management Symposium on 14 September 2020.

Building on the experience from representatives from FAO, Australia, Chile and the Republic of Korea, the symposium covered a wide range of topics and country-level experiences related to zonal management of aquaculture. Dr José Aguilar-Manjarrez (FAO), Dr Heidi Alleway (University of Adelaide, Australia), Mr Adolfo Alvial (Senior International Consultant in Aquaculture, Chile), and Dr Hyung Chul Kim (National Institute of Fisheries Science, Republic of Korea) provided global and country-level insights into the history of aquaculture zone development, policy and technical approaches, science needs and resources, as well as successes and lessons learned. The symposium drew participation from across the United States federal government, including 38 participants involved in varying aspects of aquaculture policy and research across the NOAA, the Environmental Protection Agency, the State Department, the Food and Drug Administration, and the Department of Agriculture.

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FIGURE 2



©FAO/Cindy Sandoval, NOAA Fisheries

The symposium highlighted the importance of spatial planning for promoting future aquaculture growth, placing particular emphasis on the social, economic, environmental and governance objectives of sustainable development. “AOAs developed by NOAA are an excellent initiative and a very useful framework in this context,” said Dr Aguilar. “NOAA’s AOAs can help create or support mechanisms in order to address and facilitate information exchange and support capacity-building efforts for optimal aquaculture zoning within the United States of America, but it also has great potential to enable collaboration among nations and regions at all levels.”

Beginning in the federal waters off southern California and the Gulf of Mexico (Figure 2), NOAA is using public input and the best available science for this planning effort, including advanced spatial analysis led by NOAA’s National Ocean Service, to identify AOAs that minimize interactions with other resource uses while maximizing the potential for successful aquaculture. “We look forward to continued collaboration with FAO and the international community as we navigate the challenges and benefits of developing AOAs and fostering greater opportunities for U.S. aquaculture,” said Danielle Blacklock, Director of the NOAA Fisheries Office of Aquaculture. The United States of America plans to develop ten AOAs in the coming years, while emphasizing increased efficiency and taking into account public input, industry interest and environmental reviews to guide the expansion of its sustainable domestic aquaculture industry.

With one of the largest exclusive economic zones in the world (3.4 million square nautical miles), the United States of America currently has only one commercial, open-ocean aquaculture farm operation. This farm – owned by Blue Ocean Mariculture – sustainably raises Hawaiian Kanpachi (*Seriola rivioli*) off the coast of Kona, Hawaii, and is an example of the untapped potential for sustainable marine aquaculture in the country.

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Seaweed Revolution: Where is the Next Milestone?

Seaweeds, also known as macroalgae, make up an important component of global aquaculture. In 2019, seaweed cultivation contributed nearly a quarter of the 120 million tonnes of world aquaculture production.¹ In terms of wet weight, red seaweed (Rhodophyceae) and brown seaweed (Phaeophyceae) were, respectively, the second- and third-largest species groups in global aquaculture, following “Carps, barbels and other cyprinids”.² Being mostly low-value commodities, seaweeds accounted for 5.4 percent of the USD 275 billion of world aquaculture production value in 2019. Yet, the 5.4 percent value share was higher than “Tilapias and other cichlids” or “Catfishes”, and only lower than four species groups (i.e. “Carps, barbels and other cyprinids”; “Marine shrimps and prawns”; “Salmons, trouts, smelts”; and “Crayfishes”).

However, seaweeds are not well known in many parts of the world, as seaweed production is mostly concentrated in Eastern and South-eastern Asia³ (Table 1). In 2019, the Americas and Europe each accounted for only around 1 percent of global seaweed production, and most of their seaweed production came from wild collection. Seaweed production in Africa and Oceania, which was mostly from cultivation, accounted for less than half of a percent of the world total (Table 1).

Seaweeds have recently become popular, drawing increasing attention to their potential as an alternative source of healthy food to feed the growing human population⁴ and their ecosystem services in reducing greenhouse gases.⁵



Seaweed farmer preparing a line with *Eucheuma* cuttings for on-growing. West Sumba, Indonesia.

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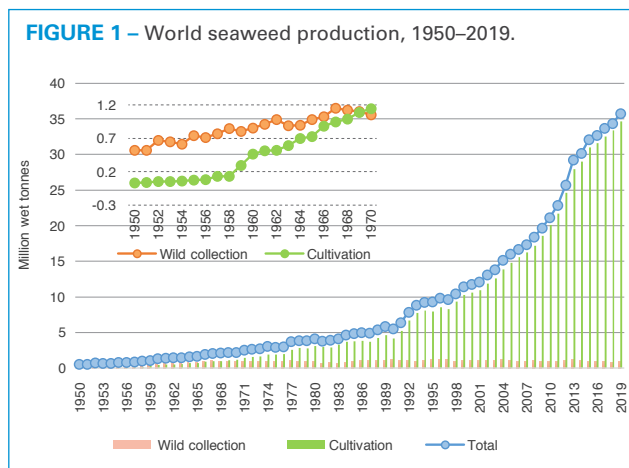
TABLE 1 - Global seaweed production, 2019

Country/area	Total production from cultivation and wild collection (tonnes)	Share of world total (%)	Aquaculture share in total production (%)
World	35 762 504	100.00	96.97
Asia	34 826 750	97.38	99.10
China	20 296 592	56.75	99.14
Indonesia	9 962 900	27.86	99.55
Republic of Korea	1 821 475	5.09	99.52
Philippines	1 500 326	4.20	99.98
Democratic People's Republic of Korea	603 000	1.69	100.00
Japan	412 300	1.15	83.80
Malaysia	188 110	0.53	100.00
Americas	487 241	1.36	4.69
Chile	426 605	1.19	5.08
Peru	36 348	0.10	0.00
Canada	12 655	0.04	0.00
Mexico	7 336	0.02	0.14
United States of America	3 394	0.01	7.75
Europe	287 033	0.80	3.88
Norway	163 197	0.46	0.07
France	51 476	0.14	0.34
Ireland	29 542	0.08	0.14
Russian Federation	19 544	0.05	54.10
Iceland	17 533	0.05	0.00
Africa	144 909	0.41	81.29
United Republic of Tanzania	106 069	0.30	100.00
Morocco	17 591	0.05	1.55
South Africa	11 155	0.03	19.32
Madagascar	9 665	0.03	91.72
Oceania	16 572	0.05	85.32
Solomon Islands	5 600	0.02	100.00
Papua New Guinea	4 300	0.01	100.00
Kiribati	3 650	0.01	100.00
Australia	1 923	0.01	0.00

1. Unless noted otherwise, aquaculture and fisheries production statistics used in this document are from FAO. 2021. *Fishery and Aquaculture Statistics. Global production by production source 1950–2019* (FishStatJ). In: FAO Fisheries Division [online]. Rome. Updated 2021. www.fao.org/fishery/statistics/software/fishstatj/en
2. The methodology of species grouping and ranking can be found in “FAO. 2020. Top 10 species groups in global aquaculture 2018”. www.fao.org/3/ca9383en/ca9383en.pdf
3. Country grouping in this article follows the United Nations M49 standard. <https://unstats.un.org/unsd/methodology/m49/>
4. Parodi, A., Leip, A., De Boer, I.J.M. et al. 2018. The potential of future foods for sustainable and healthy diets. *Nat Sustain*, 1: 782–789. <https://doi.org/10.1038/s41893-018-0189-7>
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A good example is the recently published Seaweed Manifesto,⁶ initiated by Lloyd's Register Foundation with the active support of the Sustainable Ocean Business Action Platform of the United Nations Global Compact. The Manifesto aims at increasing global interest in the responsible development of the seaweed industry through a closer collaboration among development agencies, governments, academia and the private sector.

The existence of vast marine areas suitable for seaweed farming makes champions of seaweeds envision a forthcoming “Seaweed Revolution”.⁷ However, if revolution means exponential growth, then it appears that global seaweed production has been in a revolution, powered by cultivation, since 1950 until at least the mid-2010s (Figure 1).



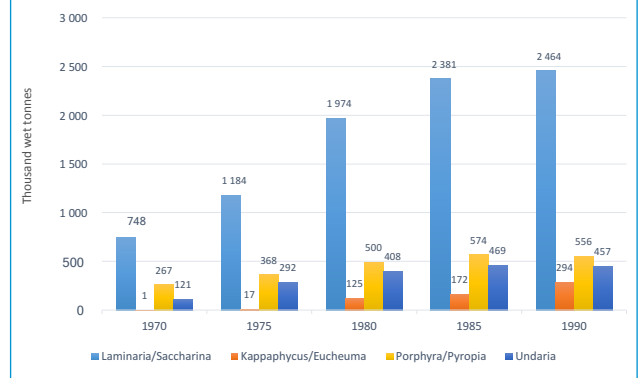
1950–1970

According to FAO statistics, world seaweed production was a little over half million (wet) tonnes in 1950, primarily from wild collection. While the wild production doubled during 1950–1970, the production from cultivation grew over 30-fold and exceeded the wild production in 1970 (Figure 1). This primarily reflects the expansion of Japanese kelp (*Laminaria* [now *Saccharina*] *japonica*)⁸ cultivation in China, from 51 000 tonnes in 1958 to 716 000 tonnes in 1970. The big leap forward was supported by the Chinese government’s promotion of kelp production and consumption as a way to fight iodine deficiency and triggered by technical breakthroughs, such as success in hatchery-reared summer seedlings⁹ and the development of longline cultivation systems.

1970–1990

The “kelp revolution” continued during 1970–1990, with the global cultivation production increasing from less than 800 000 tonnes in the early 1970s to nearly 3 million tonnes

FIGURE 2 – World seaweed aquaculture production by major species groups, 1970–1990.



in the late 1980s (Figure 2). China and the Democratic People’s Republic of Korea contributed to, respectively, 55 percent and 42 percent of the growth.

The cultivation of *Porphyra/Pyropia* (aka *zicai* in China; *nori* in Japan; and *gim* in the Republic of Korea) and *Undaria* (aka *qundaicai* in China; *wakame* in Japan; and *miyeok* in the Republic of Korea), mainly for human consumption, also had a multifold increase during the period (Figure 2). Japan contributed to most of the increase in *Porphyra/Pyropia* cultivation, whereas the *Undaria* expansion was primarily led by the Republic of Korea.

The cultivation of seaweed species for the extraction of carrageenan (carrageenan seaweeds in short) increased from virtually nothing to nearly 300 000 tonnes during 1970–1990 (Figure 2). This reflects the cultivation of fast-growing tropical species (*Kappaphycus/Eucheuma*) in countries with lower labour cost (primarily the Philippines) replacing wild collection of cold-water species (e.g. *Chondrus crispus*) in developed regions (primarily Canada) as the main source of carrageenan seaweeds.

1990–2019

The world cultivation production of kelp (*Laminaria/Saccharina* spp.) continued to increase over the past three decades to 12.3 million tonnes (USD 4.6 billion) in 2019 (Figure 3). China remained the primary contributor to the growth, whereas the production in the Republic of Korea increased from 8 000 tonnes to 663 000 tonnes between 1990 and 2019. Besides increasing demand from its growing population, the industrial use of kelp to produce alginate and other biochemical products (for example mannitol, sorbitol, fucoidan, fucoxanthin and phlorotannin) was one of the main driving forces behind the expansion of kelp cultivation in China during this period. The use of seaweeds as feed for cultivating high-value aquatic animal species (primarily abalones) has also created substantial demand for kelp and other seaweeds. On the supply side, continuing efforts in improving kelp seedlings have not only increased

6. <https://unglobalcompact.org/library/5743>

7. <https://seaweedrevolution.live.ft.com/>

8. To avoid unnecessary confusion, this article follows nomenclatures adopted in FAO statistics and indicates more updated taxonomic names.

9. FAO 2004–2021. Cultured Aquatic Species Information Programme. *Laminaria japonica*. Cultured Aquatic Species Information Programme. Text by Chen, J. In: FAO Fisheries Division [online]. Rome. Updated. [Cited 20 March 2021].

10. Valderrama, D., Cai, J., Hishamunda, N. & Ridler, N., eds. 2013. *Social and economic dimensions of carrageenan seaweed farming*. Fisheries and Aquaculture Technical Paper No. 580. Rome, FAO. 204 pp.

the productivity of kelp cultivation but also expanded farming activities to geographical areas with warmer seawater temperatures (for example the Fujian Province in South-eastern China).

Kappaphycus/Eucheuma appeared to be a rising star challenging the dominance of kelp in global seaweed aquaculture (Figure 3). Technical breakthroughs in the production of less expensive food-grade semi-refined carrageenan have significantly increased the demand for carrageenan by the food processing industry in developing regions (particularly China). The strong demand has helped Indonesia to become the main supplier of carrageenan seaweeds since the late 2000s. Key factors behind the success include (i) conducive climate conditions for tropical seaweed farming; (ii) abundant suitable cultivation sites in this extended archipelago made accessible by effective community-based coastal management; and (iii) a large labour force in rural fishing communities looking for alternative activities to support their livelihoods threatened by overfishing.

In 2019, Indonesia and the Philippines accounted for, respectively, 84 and 13 percent of the 11.6 million tonnes of world aquaculture production of *Kappaphycus/Eucheuma*, and the rest was contributed by a number of countries in Asia (primarily Malaysia and Viet Nam), Africa (primarily United Republic of Tanzania and Madagascar) and the Pacific (primarily Solomon Islands, Papua New Guinea and Kiribati) (Table 1). *Kappaphycus* has been the main species in all the countries except for Zanzibar (United Republic of Tanzania) where lower-valued *Eucheuma denticulatum* was resorted to when the attempt to cultivate *Kappaphycus* failed because of disease problems.



Women cleaning and sorting *Eucheuma* seaweeds placed to dry under the sun. West Sumba, Indonesia.

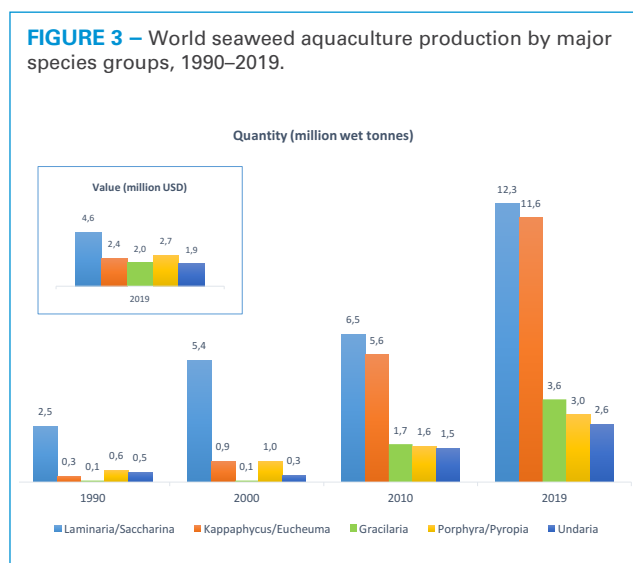
©FAO/GS Patro (photo taken before COVID-19 pandemic)

Similar to *Kappaphycus/Eucheuma* yet to a lesser extent, cultivation of *Gracilaria* (primarily used for the extraction of agar) increased from 70 000 tonnes in 2000 to 3.6 million tonnes in 2019 (Figure 3). China contributed to most of the growth and accounted for 96 percent of the production in 2019. In addition to being used to extract agar, a large amount of China's *Gracilaria* production has been used to feed abalone. Besides China, Indonesia was the only country with *Gracilaria* cultivation over 100 000 tonnes in the same year. It has been a popular practice in the country to cultivate *Gracilaria* in shrimp ponds. Besides China and Indonesia, Chile and Viet Nam are another two countries with relatively large *Gracilaria* cultivation (over 10 000 tonnes in 2019).

Porphyra/Pyropia is a high-value cold-water red seaweed primarily for direct human consumption. Japan was the largest *Porphyra/Pyropia* producer in 1990, accounting for 70 percent of the world production. Despite the decline of *Porphyra/Pyropia* production in Japan from 387 000 tonnes in 1990 to 251 000 tonnes 2019, the world *Porphyra/Pyropia* aquaculture production increased to 3 million tonnes in 2019 thanks to production expansion in China and the Republic of Korea, which accounted for, respectively, 71 percent and 20 percent of the world production. The USD 2.7 billion of world production value ranked it second in terms of value (only lower than the USD 4.6 billion of kelp production). Indeed, while in terms of tonnage *Kappaphycus/Eucheuma* aquaculture production in 2019 was nearly four times as high as that of *Porphyra/Pyropia*, the production value of the former was nevertheless only 90 percent of the latter (Figure 3) because of the much higher price of *Porphyra/Pyropia* (average USD 0.89/kg in 2019) compared to *Kappaphycus/Eucheuma* (USD 0.21/kg) as well as the other three major seaweed species groups: kelp (*Laminaria/Saccharina*; USD 0.37/kg), *Gracilaria* (USD 0.54/kg) and *Undaria* (USD 0.75/kg). This reflects the stylized fact that seaweeds for direct human consumption tend to fetch a higher price than those for industrial uses.

In 1990, the Republic of Korea and Japan accounted for, respectively, 59 percent and 25 percent of world cultivation

FIGURE 3 – World seaweed aquaculture production by major species groups, 1990–2019.



of *Undaria*. While the *Undaria* production in the Republic of Korea nearly doubled from 269 000 tonnes to 495 000 tonnes between 1990 and 2019, that of Japan declined by more than half from 113 000 tonnes to 45 000 tonnes. However, the increase of world *Undaria* cultivation by fivefold from 457 000 tonnes to 2.6 million tonnes was primarily contributed by China whose 2 million tonnes of *Undaria* production in 2019 accounted for 79 percent of the world total. As the brown seaweed counterpart of *Porphyra/Pyropia*, *Undaria* is also primarily used for direct human consumption, and its price (USD 0.75/kg in 2019) was lower than that of *Porphyra/Pyropia* (USD 0.89/kg) but higher than kelp (USD 0.37/kg).

Prospects

Despite the ever growing interest in seaweeds as human food, it tends to take a long time for seaweeds to become a major source of protein or food energy for humanity under normal circumstances. However, the experiences in Eastern Asia indicate that seaweeds could become nutritious sea vegetables commonly and frequently consumed in many countries. Achieving this milestone entails joint efforts of stakeholders and experts in policy, business and scientific communities to make seaweeds “acceptable”, “available” and “affordable”. Fostering the 3As will be a long-term process which nevertheless seems to be gaining momentum.

The development of *Kappaphycus/Eucheuma* farming indicates that applications other than direct human consumption could drive significant seaweed development. However, key elements behind the success, such as (i) being a competitive raw material to produce a unique product with widespread applications that are difficult to be replaced by substitute products and (ii) availability of abundant farm sites and a large suitable labour force to produce the material at low cost, are difficult to replicate. It is unclear which application(s) (for example pharmaceutical, nutraceutical, cosmetic, animal feed, biofuel, biofertilizer/biostimulant, bio-packaging, textile fibres, carbon sequestration, among others) is most likely to become the next milestone(s) in the seaweed revolution. Yet persistent and painstaking efforts in innovations are the ultimate key to jump starting the process leading to the milestone(s).

A key factor that has drawn increasing attention to seaweeds is the services they provide to our ecosystem. While growing a large amount of seaweed biomass and burying them in the deep ocean as carbon sinks seems to be a desperate last resort to buy time against climate change, integrated multi-trophic aquaculture (IMTA) tends to be a more efficient way to cash in the ecosystem services of seaweeds. IMTA is conceptually appealing yet technically/economically challenging and has yet to become a widely adopted farming system, yet there are encouraging success stories (for example Sanggou Bay in China).¹¹ Therefore, widespread adoption of IMTA in global aquaculture to integrate seaweed cultivation with other farming activities could be a next milestone in the ongoing seaweed revolution.

11. Fang, J., Zhang, J., Xiao, T., Huang, D. & Liu, S. 2016. Integrated multi-trophic aquaculture (IMTA) in Sanggou Bay, China. *Aquacult Environ Interact*, 8: 201–205. <https://doi.org/10.3354/aei00179>



Seamoss (*Kappaphycus* sp.) seen here in St Kitts and Nevis, is an important aquatic product for people across the Caribbean, often processed into a health food drink.



©FAO/T. Moth Poulsen (photo taken before COVID-19 pandemic)

State of World Aquaculture 2020 and Regional Reviews FAO Webinar Series

Background

Ahead of the Global Conference on Aquaculture Millennium +20 (GCA +20), FAO convened a series of webinars to present the advanced findings of six *Regional Reviews of Aquaculture* and the *State of World Aquaculture 2020* during the week of 26–29 October 2020, the original dates of the GCA +20.

Starting in 1997, FAO has produced Global and Regional Aquaculture Reviews¹ about every five years. These reviews provide up-to-date information on the status and trends of the sector, at regional and global levels, developed from national, regional and global data sets and supplemented with expert opinion and literature reviews. The reviews can be pertinent and of interest and use to government authorities, international and regional organizations, policy-makers, aquaculture farmers and other aquaculture value chain actors, investors, civil society organizations, academia and training institutions, as well as other interested stakeholders. The final reviews will be published later this year and presented at the Global Conference on Aquaculture Millennium +20 in Shanghai, China (www.aquaculture2020.org). Each webinar followed the same format, starting with opening remarks from a keynote speaker, then a presentation of the major findings and suggested ways forward, followed by a panel discussion. A final question and answer session provided opportunity for interested parties to comment on the reviews presented.

This article summarizes the key messages and findings from the *State of World Aquaculture 2020*, a global synthesis of

- www.fao.org/fishery/regional-aquaculture-reviews
- The term "fish" indicates fish, crustaceans, molluscs and other aquatic animals, but excludes aquatic mammals, crocodiles, caimans, seaweeds and other aquatic plants.

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all six regional reviews, as presented during the webinar on 29 October 2020. A video recording of each webinar can be found here: www.aquaculture2020.org/reviews.

Production and consumption

In 2018, global aquaculture production, including aquatic plants was 114.5 million tonnes, with an estimated value of USD 263 billion. The production was comprised of farmed aquatic animals, aquatic plants and non-food products. The Asia-Pacific region remains the major producer, with only four of the top 15 producing countries being outside the region (Brazil, Chile, Egypt and Norway). Globally, aquaculture now provides over 50 percent of fish² for human consumption. Global food supply and apparent per capita consumption of fish and fish products continue to increase faster than human population growth. However,

INTRODUCTION AND KEYNOTE

Welcome remarks	Manuel Barange Director, Fisheries Division, FAO
Opening remarks	Antonio Garza de Yta Secretary, Fisheries and Aquaculture, State of Tamaulipas, Mexico
The State of World Aquaculture 2020 –Status, Trends and Options for the Way Forward	Devin Bartley Senior Research Associate, World Fisheries Trust

EXPERT PANEL DISCUSSION

Mainstreaming nutrition in aquaculture	Shakuntala Thilsted Research Program Leader, Value Chains and Nutrition, WorldFish
Role of regional and global cooperation in aquaculture	Semoli Belemane Chief Director, Aquaculture, Department of Environment, Forestry and Fisheries, South Africa
Women in aquaculture production, fish value chains and trade	Cecile Brugere Director, Soulfish Research and Consultancy, United Kingdom

Q&A AND CONCLUSION

Question and Answer session	
Closing remarks	Maria Helena Semedo Deputy Director-General, FAO

Moderator: **Matthias Halwart**, Head, Aquaculture Branch, FAO.

in parts of Africa fish consumption has decreased. Panelist Shakuntala Thilsted reinforced the importance of mainstreaming human nutrition in aquaculture policies and practices, stressing the important contributions of vitamins, minerals and beneficial fatty acids that aquatic food can contribute to a healthy diet. However, large variations in production and consumption are found between regions, between countries, and even within countries between different consumer groups in contexts of very different levels of aquaculture development.

Aquaculture growth

Aquaculture is the fastest growing food production sector due in part to the diversity of the sector, which includes a diversity of farmed species, farming systems and farming environments. Aquaculture is practiced in a diversity of environments from tropical rice fields to sub-Arctic seas. In 2018, aquaculturists farmed about 622 species and/or species groups, including 387 finfishes, 111 molluscs, 64 crustaceans, 7 frogs and reptiles, 10 miscellaneous aquatic invertebrates, and 43 aquatic plants.

From 2000 to 2018, aquaculture production in freshwater, brackish water and marine water increased at a compound annual growth rate of 5.7, 7.7 and 5.2 percent, respectively; the growth rate of total aquaculture production was 5.6 percent. Aquaculture in marine waters contributed the most to global production with 55.5 million tonnes. The freshwater fishes had the highest production at 46.0 million tonnes. In 2018, an estimated 20.5 million people (34 percent of a total of fishers and fish farmers) were engaged in aquaculture.

Although more people are involved in capture fisheries worldwide, there is a higher percentage of women involved in aquaculture than in capture fisheries. Panelist Cecile Brugere expanded upon gender issues, explaining that, while many women are involved in small-scale aquaculture and are the main workforce in the processing subsector, they are often found in unskilled and low-paying positions. As such, gender-sensitive aquaculture interventions are essential to improve gender equality in the aquaculture sector, with positive impacts on the overall sector and the community at large.

Innovation, feed and seed

Aquaculture innovation is increasing production and sustainability. While traditional pond and cage systems continue to provide the bulk of aquaculture production, newer systems such as aquaponics, although still with low levels of production, are expanding in some areas where water and land are scarce, such as in sub-Saharan Africa and the Near East and North Africa. Progress in biosecurity and fish health management, feed formulation and genetic resource management are showing good, but uneven, progress globally.

Feed is often the most expensive component of an aquaculture budget, and the majority of farmed species require the addition of feed. Fed aquaculture's share



Fish farmers in Mulindi, Kenya, harvesting tilapia.

©FAO/IT. Mutesi (photo taken before COVID-19 pandemic)

of overall aquatic animal production increased from 56.1 percent in 2000 to 69 percent in 2018. Globally, aquaculture uses about 18 million tonnes of fish in the formulation of fish and animal feeds; this value has fluctuated over the past years primarily based on anchoveta capture fisheries production. The harvest of forage fish has remained relatively constant over several decades, while aquaculture production has increased dramatically.

The majority of farmed aquatic species rely on seed produced in hatcheries or other controlled or semi-controlled environments. Although domestication and genetic improvement have played a large role in the increased production in some species, for example Atlantic salmon, whiteleg shrimp, American catfish, Nile tilapia and common carp, the most widely cultured farmed type for all farmed aquatic species is still the wild type.

The future

The aquaculture sector faces challenges from competition for land and water resources from external pressures such as climate change, conflict, economic uncertainties and, most recently, the COVID-19 pandemic. Commitments by sector stakeholders and governments to good governance including resilience and capacity development will help the sector meet these challenges. Cooperation, partnerships and capacity development are essential to the future sustainable growth of aquaculture, a point underlined by Panelist Semiole Belemane during his panel intervention. Proactive stakeholder engagement, social focus and science-based communication are crucial in cultivating the positive image of aquaculture and addressing negative public perceptions. Moving beyond “tonnes and dollars”, the future of aquaculture will be instrumental in creating local benefits and sustainable livelihoods, improving food security and nutrition, and in helping countries implement the 2030 Agenda for Sustainable Development. Maria Helena Semedo, FAO Deputy Director-General, reinforced this point during her closing remarks, stating that aquaculture can help countries deliver on the Sustainable Development Goals as an integral game changer transforming the global food system.

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A video recording of the webinar can be found here: www.aquaculture2020.org/reviews

Webinar: Regional Review on Status and Trends in Aquaculture Development in Asia-Pacific - 2020

This article summarizes the key messages and findings from the regional review on the status and trends of aquaculture development in Asia and the Pacific, which were presented during the FAO webinar held on 23 October 2020. A video recording of each webinar can be found here: www.aquaculture2020.org/reviews.

Matthias Halwart, Chief of Aquaculture Branch of FAO, introduced the preparation of the regional review of aquaculture in Asia and the Pacific and the webinar in relation to the Global Conference on Aquaculture +20 to be held in September 2021 in Shanghai, China. Jong-Jin Kim, Assistant Director-General and Regional Representative of FAO for Asia and the Pacific, delivered an opening remark, which highlighted the contribution of aquaculture growth and the need for its continued growth in a sustainable manner in the region. Yuan Derun, Senior Programme Officer of the Network of Aquaculture Centres in Asia-Pacific, who is one of the two lead authors of the regional review, presented important findings and key messages on the status and future trend of aquaculture in Asia and the Pacific. As invited panelists, three experts – Tarun Shridhar, former Secretary of the Union Ministry of Fisheries, Animal Husbandry and Dairying, India; Robert Jimmy, Aquaculture Adviser of the Pacific Community; and Shirlene Maria Anthonysamy, Director of INFOFISH – provided their insight on specific topics of great importance to future development of aquaculture in the region and, together with the lead author, answered audience questions. The major findings and key messages from the regional review include the following.

Overwhelmingly, the Asia-Pacific region remains a major contributor to global aquaculture production (92 percent of global production, with total production of 105 million tonnes in 2018). Aquaculture production continued the growth trend during the period 2008–2018 at an average annual growth rate of 5.2 percent, but to date the growth rate is showing a declining trend. Aquaculture growth has greatly contributed to livelihoods and nutritional improvement in the region. Per capita fish consumption in the region reached 24.1 kg in 2017, with aquaculture supplying over 60 percent of food fish for the population. Fish composes 25.2 percent of dietary animal protein for the people in the region, which is significantly higher than the global average. The aquaculture sector employs 19.6 million people in primary production and provides the same number of job opportunities in related supporting

and service sectors in the region. However, a great disparity in aquaculture development exists between the different subregions despite the general trend of growth. For instance, as the largest aquaculture producer in the world, China contributes 63 percent of the region's aquaculture, and Southeast Asia contributes 23 percent of the region's production. In contrast, Oceania and the Central Asia and Caucasus subregions together contribute less than 0.3 percent of regional aquaculture production. Strategies to promote aquaculture growth in underdeveloped areas include (i) promoting awareness of the potential contribution of aquaculture to poverty and nutrition related to the Sustainable Development Goals (SDGs); (ii) integrating aquaculture into national development policy; (iii) building capacity development for the local supply of key aquaculture inputs, particularly feed and seed; and (iv) promoting technology transfer and sharing development approaches across the subregions.

Significant improvement has been made in aquatic animal health management across the region, demonstrated by strengthened biosecurity in aquaculture and development of national strategies for aquatic animal health management and disease surveillance and monitoring systems in major aquaculture countries. The improvement not only has contributed to sustainable aquaculture growth but also has improved product safety. Some challenges remain to be surmounted, such as the antimicrobial resistance risks associated with aquaculture, the lack of alternatives to

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Opening remarks	Jong-Jin Kim Assistant Director-General/ Regional Representative, FAO Regional Office for Asia and the Pacific
Regional Review of Aquaculture in Asia and the Pacific - <i>Status, Trends and Options for the Way Forward</i>	Yuan Derun Network of Aquaculture Centres in Asia-Pacific

EXPERT PANEL DISCUSSION

Role of government in aquaculture	Tarun Shridhar Former Secretary, Union of Agriculture and Farmers' Welfare, India
Aquaculture development in the South Pacific	Robert Jimmy Aquaculture Advisor, Secretariat of the Pacific Community, Fiji
The impact of international trade on the aquaculture sector	Shirlene Maria Anthonysamy Director, INFOFISH

Q&A AND CONCLUSION

Question and Answer session	
Closing remarks	Matthias Halwart Head, Aquaculture Branch, FAO

Moderator: Miao Weimin, Aquaculture Branch, FAO.

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using antimicrobials in the control of diseases, and the weak capacity of farmers to effectively manage animal health problems.

Compared with other regions, aquaculture in the Asia-Pacific region is extremely diversified in terms of cultured commodities, farming systems and practices, and levels of intensity. Such diversity enables the sector to supply a rich diversity of products that can meet local, national and global market demands, provides different types of livelihoods and job opportunities in rural and urban areas, and makes effective use of all kinds of natural resources. Further diversification of farming systems and practices is encouraged to effectively address major challenges, such as climate change impact and changing social and economic contexts. On the other hand, extreme diversity of cultured species has been a major constraint in improving aquaculture through focused research and technology development.

Another major source of progress of the aquaculture sector in the Asia-Pacific region is the improvement of governance of aquaculture. Many countries have been making efforts to strengthen their national legislation to safeguard the development of the sector, including revision of the overarching fisheries law that covers aquaculture sectoral matters and various specific regulations targeting the aquaculture sector, ranging from biosecurity control, aquaculture food safety, resource planning and management, environmental standards, and registration/licencing to social standards. It is recognized that the level of aquaculture governance is very uneven across the region. The effectiveness of enforcement of existing laws, regulations and standards on the ground is inadequate to ensure the sustainability of the sector.

The Asia-Pacific region has remained a major supplier of internationally traded aquatic products. In 2018, countries in the region exported 15.2 million tonnes of aquatic products, which accounted for 36.5 percent of total global export of aquatic products. The export volume of aquatic products increased by an annual average rate of 3 percent between 2008 and 2018. The total value of exported aquatic products from the countries in the region reached USD 65.8 billion in 2018, which accounted for

39.5 percent of the global total. The export value increased by an average annual rate of 6.6 percent over the period 2008–2018. Along with the overall growth trend of international trade of aquatic products, there has been a significant increase in the intraregional trade of aquatic products. The growth in international trade of aquatic products has been an important driver for aquaculture development in the region. The increasingly high food safety and social standards for imported aquatic products have promoted good aquaculture practices. Simultaneously, these practices have forced small farmers to invest more to meet the standards. While their investment does not receive much of a return in terms of an anticipated market premium, it does maintain access to markets.

While the aquaculture sector keeps growing in the region, threats such as climate change impacts, major disease outbreaks, market volatility and other disasters such as the COVID-19 pandemic further increase the vulnerability of the smallholders, who often bear the most risk and share the least benefit among all the stakeholders in the supply and value chain. There is urgent need to build resilience of small farmers through technology innovation, transformative changes in farming system/practices, and more equitable supply and value chains supported with digital aquaculture and market diversification.

Sustainable growth of aquaculture in the Asia-Pacific region is highly desirable for greater contribution to the attainment of several SDGs related to poverty alleviation, nutrition and social well-being, regionally and globally. Such growth will support better production, better nutrition, better environment and better life. The following strategies are recommended to support the member countries in pursuing this goal:

- Strengthen collaboration between international and regional organizations, such as the Network of Aquaculture Centres in Asia-Pacific, through the FAO Hand-in-Hand initiative and South-South and Triangular Cooperation.
- Strengthen regional cooperation in promoting aquaculture development in underdeveloped areas, such as the Small Island Developing States regional network.
- Enhance public-private partnerships and small and medium-sized enterprises in promoting sustainable growth of aquaculture in the region.
- Strengthen advocacy on the improvement and contribution of the aquaculture sector in the Asia-Pacific region.

REFERENCES

A video recording of the webinar can be found here: www.aquaculture2020.org/reviews



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Aquaculture harvest in Viet Nam.

Webinar: Regional Review on Status and Trends in Aquaculture Development in the Near East and North Africa – 2020



Commercial marine fish cage farm off the Mediterranean coast of Morocco.

In September 2021, FAO, in close collaboration with the Chinese Ministry of Agriculture and Rural Affairs and the Network of Aquaculture Centres in Asia-Pacific (NACA), will organize the Global Conference on Aquaculture Millennium +20 (see www.aquaculture2020.org). Day one of this Conference will review the developmental status of global aquaculture and will do so by focusing on the industry status, trends and emerging issues in different regions of the world. In preparation of this important event, FAO has engaged a large number of experts and is in the process of finalizing six regional aquaculture reviews that will be published later this year. The key development, constraints and outlooks of the sector for each region will also be presented and discussed at the Conference.

The preliminary findings of the *Regional Review on Status and Trends in Aquaculture Development in the Near East and North Africa* were presented in October 2020 at a webinar organized by FAO (the video recording is available here: www.aquaculture2020.org/reviews). Below is a brief summary of the sector in the Near East and North Africa (NENA) region.

The NENA region covers a wide territory that extends from Iraq to the east of the Arabic Peninsula all the way across northern Africa to Morocco on the Atlantic coast, covering a total land mass of 9.8 million km². The region is mostly arid or semi-arid but has extensive coastlines and includes a wide range of economies, from high-income, hydrocarbon-rich countries to low-income countries. In 2018, NENA aquaculture production was worth USD 2.3 billion, two-thirds of which came from Egypt as the leading producer. Production has doubled over the past decade, reaching a historical high of 1.7 million tonnes in 2018. Egyptian fish farms accounted for 92 percent of production and Saudi

Arabia for 4.2 percent; other significant producers included Iraq (25 737 tonnes), Tunisia (21 826 tonnes), Algeria (5 100 tonnes), the United Arab Emirates (3 350 tonnes) and the Syrian Arab Republic (2 350 tonnes).

A total of 43 species of finfish, shellfish and aquatic plants were farmed in the region. Tilapia (mainly *Oreochromis niloticus*) was produced in 14 NENA countries and represented 63 percent of total production, followed by mullets (14 percent) and the major carp species (12 percent). Farming of marine finfish (mainly gilthead seabream, *Sparus aurata*, and European seabass, *Dicentrarchus labrax*) and the whiteleg shrimp (*Litopenaeus vannamei* – mainly in

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Opening remarks	Saud Al-Habsi Minister, Agriculture, Fisheries Wealth and Water Resources, Oman
Regional Review of Aquaculture in North Africa and the Near East – Status, Trends and Options for the Way Forward	Malcolm Dickson Former Country Director, WorldFish

EXPERT PANEL DISCUSSION

Roles of government and private sector in aquaculture development	Majida Maârouf Director, National Aquaculture Development Agency, Morocco
Future developments, innovation and climate change	Ali M. Al Shaikhi Director General, General Directorate of Fisheries, CEO, National Fishery Development Program, Ministry of Environment, Water and Agriculture, Kingdom of Saudi Arabia
Markets as key drivers for aquaculture development	Shérif Sadek President, African Chapter, World Aquaculture Society, Director, Aquaculture Consultant Office, Egypt

Q&A AND CONCLUSION

Question and Answer session	
Closing remarks	Matthias Halwart Head, Aquaculture Branch, FAO

Moderator: **Alessandro Lovatelli**, Aquaculture Branch, FAO.

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Tilapia harvest in an integrated fish-crop-livestock farm in Al Ain, United Arab Emirates.

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Saudi Arabia) lagged behind, accounting for only 6 percent and 3 percent in volume, respectively. Almost all countries, however, have high ambitions to expand aquaculture, particularly in the marine environment, often for improved food self-sufficiency and/or reduced dependence on imports. The capacity to grow marine finfish other than those typically produced in the Mediterranean, such as grouper, amberjack and yellowtail, is increasing in the Gulf States, but their quantities remain limited while the Asian seabass (*Lates calcarifer*) is successfully being produced in Saudi Arabia and the United Arab Emirates. Small amounts of bivalve shellfish are farmed in Algeria, Morocco, Tunisia and the United Arab Emirates, while even smaller quantities of aquatic plants are grown in Morocco and Tunisia.

There is good potential for further growth of aquaculture production in the region through sustainable intensification of inland, freshwater and brackish-water aquaculture, as well as expansion of marine aquaculture systems backed by strong policy, financial support and technological innovations. Egyptian aquaculture production has grown on the commitment by the government to allocate space and resources for development of the sector. Similar commitments are being made by other NENA countries, such as Bahrain, Morocco, Oman, Saudi Arabia, Tunisia and the United Arab Emirates, including establishing dedicated aquaculture development zones. Relevant and important environmental legislations have been enacted by most countries, although aquaculture management systems need to be improved along with ensuring efficiencies in the use of feeds and resources use, particularly freshwater.

Until now, most aquaculture production in the NENA region has been for domestic markets, often with little attention paid to maintaining effective cold chains in post-harvest handling and market systems. Several countries lack the capacity to participate effectively in global aquaculture trade, as they have not implemented essential testing frameworks or lack effective marketing organizations. There is very little processing or packaging and the COVID-19 pandemic has demonstrated the importance of local and flexible marketing systems, including online retailing. However, Saudi Arabia exports high-quality shrimp to global markets, and several other countries are investing in the infrastructure and processes for exports. Egyptian aquaculture demonstrates that the sector can improve food self-sufficiency and food security as well as provide employment and incomes in rural areas where there are few alternatives.

During the closing remarks of the NENA aquaculture review webinar, Dr Malcolm Dickson, author of the review document, noted the importance for the sector to be better represented to ensure a stronger and more effective dialogue between the public and private sector. Aquaculture development policies and institutional support mechanisms need to build on success and learn lessons from successful developments in the region and beyond. The one-stop-shop approach applied in Morocco and Oman and the allocation of aquaculture zones in some countries in the region will certainly facilitate future investment in the sector.

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A video recording of the webinar can be found here:
www.aquaculture2020.org/reviews

Webinar: Regional Review on Status and Trends in Aquaculture Development in Europe – 2020

This article summarizes the key messages and findings from the regional review on the status and trends of aquaculture development in Europe, as presented during a webinar held on 26 October 2020. A video recording of each webinar can be found here:

www.aquaculture2020.org/reviews.

Aquaculture integration in regional policies, social license, crisis management and resilience

In her opening remarks, Ms Lorella de la Cruz Iglesias emphasized the important role for aquaculture in the European Union's Green Deal and the food systems approach, including the potential for aquaculture integration in the call *From Farm to Fork*. She recognized that the social license to operate has become very important for the sector and for individual operations. Based on Member States' aquaculture strategic plans, the European Union is developing a vision for the aquaculture sector, which foresees that support will be provided for sustainable development. However, crises such as the COVID-19 pandemic that has disrupted supply chains and climate change that is affecting aquaculture need to be addressed. The resilience in the food sector, including aquaculture, needs to be strengthened.

Continued growth, public acceptance, sustainability and demand for aquaculture products

Mr Courtney Hough, author of the regional review, confirmed that aquaculture will continue to grow in Europe, although this growth will likely be with higher-value marine species and with controls and restrictions on site capacity. The potential for integrating aquaculture with other activities is significant and needs facilitation and support, primarily by national and local administrations. Climate change is challenging European aquaculture operations and enterprises, affecting planning and investment. Public acceptance imposes the need to improve and implement best practices supported by certification and labelling. Sustainability will be a core guideline for the consumer, but clear and understandable definitions are needed for measurable criteria. Mr Hough further highlighted new prospects for aquaculture products in a strong European market, demanding products that are processed, packaged, ready-to-cook and easy-to-consume; the preference for local produce sold locally is a trend confirmed during the COVID-19 pandemic.

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Technology and research

Aquaculture production technology and management will advance, assuring the health and welfare of stocks and productivity. Ms Ingrid Olesen stressed that selecting, breeding and culturing selected stocks need more support. Prioritization of fewer species is most important, which helps focus support on targeted responsible practices, and sustainable feeds development and breeding programmes. However, given the lack of diversity in monoculture systems, species diversification may be important in some cases. Given aquaculture's low carbon footprint, the research and development priority should be to exploit the climate mitigation potential from carbon sequestration and storage using the aquaculture of low trophic level species such as macroalgae and mussels. Integration with wind farms may provide additional energy and cost-efficient opportunities.

Innovative governance

Ms Selina Stead highlighted that European aquaculture is not realizing its full potential due to lack of political will and lack of a comprehensive and cohesive planning system for food production from aquatic resources. She recommended three actions for innovative governance: (i) change the narrative about aquaculture and emphasize benefits of aquaculture; (ii) embrace good governance principles, such as cohesion, openness, participation,

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Opening remarks	Lorella De La Cruz Iglesias Deputy Head of Unit/ Coordinator of Aquaculture Team, Directorate-General for Maritime Affairs and Fisheries, European Commission
Regional Review of Aquaculture in Europe - <i>Status, Trends and Options for the Way Forward</i>	Courtney Hough <i>former</i> General Secretary of Federation of European Aquaculture Producers. European Aquaculture Technology and Innovation Platform
EXPERT PANEL DISCUSSION	
Aquaculture research, technology and innovation	Ingrid Olesen Senior Scientist, NOFIMA, Norway
Sustainable aquaculture development and the socio-economic dimension	Selina Stead Head, Institute of Aquaculture, Scotland, United Kingdom
Producers perspectives: regulations, licensing, markets and trade	Lara Barazi-Yeroulanos Chief Executive Officer, Kefalonia Fisheries S.A., Greece
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Moderator: Uwe Barg, Aquaculture Branch, FAO.

effectiveness and accountability of the sector to build trust through transparency in decision-making and planning; and (iii) better engage the wider public in decisions about the trade-offs between aquaculture expansion and other sectors. She called for sound data to balance environmental concerns with social and economic parameters and for systems thinking as well as open innovation to help create cohesive and comprehensive aquaculture planning systems.

Producers' challenges and innovations

According to Ms Lara Barazi-Geroulanou, the European aquaculture sector is part of, and has immediate access to, the largest markets for its products. However, the sector suffers from limited access to space and onerous bureaucracy, difficult licensing and regulatory environments, which have negative effects on production

growth and competitiveness vis-à-vis non-European Union producers. Ms Barazi-Geroulanou recommended better communicating aquaculture to the public and prioritizing: (i) innovative production methods, such as land-based recirculating aquaculture systems, offshore farms and multi-trophic, multi-functional, multi-usage platforms; (ii) innovation in species selection and product form, raw materials and therapeutics; and (iii) innovative data gathering, data analysis and artificial intelligence as means to better manage production and responsiveness to the sector's markets.

REFERENCES

A video recording of the webinar can be found here: www.aquaculture2020.org/reviews



Juvenile sturgeon in an aquaculture facility.

Webinar: Regional Review on Status and Trends in Aquaculture Development in North America – 2020

This article summarizes the key messages and findings from the regional review on the status and trends of aquaculture development in North America, as presented during a webinar held on 27 October 2020. A video recording of each webinar can be found here: www.aquaculture2020.org/reviews.

Danielle Blacklock, Director of the Office of Aquaculture of the National Marine Fisheries Service of the United States of America, opened the webinar. Steve Cross, Director of Applied Research at the Conestoga Institute of Technology, University of Victoria, the lead author of the regional review, presented the main findings and key messages related to North American aquaculture over the past five years. Three aquaculture experts provided their insights and expanded upon the main outcomes. The panelists were Mark Lawrence, professor at Mississippi State University and Director of the Feed the Future Innovation Lab for Fish; Susan Farquharson, Executive Director of the Atlantic Canada Fish Farmers Association; and Bren Smith, Executive Director and Co-founder of the integrated aquaculture farm Green Wave.

Production, value and expanding markets

North America contributes a small and relatively steady level of aquaculture production (600 000 to 650 000 tonnes annually). Despite the stable evolution, the value of the production has continued to rise over the past 25 years. In other words, the same amount of production has become more valuable. Much of this increase can be attributed to value-added initiatives, which include branding, eco-certification and packaging. In order to take advantage of this value addition, the sector will need to embrace such initiatives, address consumer needs and further diversify product lines. Bren Smith described the multiple products produced on his regenerative ocean farm, which combines shellfish and seaweed farming, listing food products of seaweed flours, plant-based burgers and shellfish, as well as non-food products such as fertilizer and bioplastics. He also noted the opportunity for blue carbon credits for seaweed farms if the seaweed is sequestered in the soil.

Expanding markets will also drive the development of North American aquaculture. The growing global demand for diversified seafood is a likely stimulant to increase production in North America. Therefore, stakeholders should be aware of the opportunities and challenges

associated with export of seafood products, for example the recent and ongoing restructuring and expansion of trade agreements, when reacting to the changing market environment.

Innovation and diversification

North America has been at the forefront of aquaculture innovation, including the research, development and application of emerging technology. Some examples of farm-based technologies include recirculating aquaculture systems and shellfish depuration systems, as well as the application of sensor integration and robotics. Application of breeding technologies has led to improved farmed types. Innovation contributes to increased on-farm productivity and a decrease in the associated cost of production. Mark Lawrence highlighted the importance of these innovations in catfish farming, noting specifically the hybrid catfish, increased aeration and management of nitrogenous waste through split-pond technology, and stating that these innovations have increased production per unit area.

The North American aquaculture sector has shown growing interest in the diversification of species, stemming from several factors. Some of these efforts include sablefish, Arctic char, sea cucumbers and sea urchins. Notably, the region is beginning to embrace opportunities associated

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Opening remarks	Danielle Blacklock Director, NOAA Office of Aquaculture, United States of America
Regional Review of Aquaculture in North America – Status, Trends and Options for the Way Forward	Steve Cross Natural Sciences and Engineering Research Council of Canada

EXPERT PANEL DISCUSSION

Innovation and the role of cooperation between farmers, researchers and government	Mark Lawrence Professor, Mississippi State University Director, Feed the Future Innovation Lab for Fish, United States of America
Participatory models of governance and stakeholder engagement	Susan Farquharson Executive Director, Atlantic Canada Fish Farmers Association, Canada
Seaweed production, regenerative ocean farming and key issues for international collaboration	Bren Smith Executive Director/ Co-Founder Green Wave, United States of America

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Closing remarks	Matthias Halwart Head, Aquaculture Branch, FAO

Moderator: **Austin Stankus**, Aquaculture Branch, FAO.

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with seaweed aquaculture, recognizing extensive and optimal growing conditions. The reasons behind the move towards diversification are multifaceted: as a business risk mitigator in regions of fluctuating or uncertain seafood product supply and demand; to take advantage of new and expanding markets; to mitigate environmental impacts; and as part of an adaptive strategy for responding to climate change.

Social license and governance

One of the major constraints to aquaculture development and expansion in North America is associated with social license, which is to say necessary acceptance of local stakeholders and the general community for aquaculture to operate. Negative public perceptions of the aquaculture industry continue to have an impact on growth. However, industry response and support by governmental initiatives have become eager to improve its image. Susan Farquharson remarked how governance influences social license, recognizing that current marine aquaculture is the responsibility of multiple agencies and noting the importance of harmonized policy for supporting sustainable development. The final key finding of the regional review is that the regulatory burden has remained high, with

sometimes excessive and poorly harmonized regulations. However, a comprehensive regulatory framework has been successful (in part) to satisfy public perception issues regarding the sustainability and “safety” of farmed seafood products. At the same time, it has constrained development through higher costs of doing business, delays in permitting, and reluctance of investment. Current initiatives in the United States of America and Canada are addressing these constraints to growth.

A move towards an efficient yet supportive regulatory environment for aquaculture, which also maintains protections for the environment and coastal and land use management, as well as seafood safety, would enable the sustainable development of the sector. Danielle Blacklock reinforced this point in her opening statement, noting the ongoing strategic planning, a review of risk assessment and the development of new opportunity areas in the United States of America, all of which will revolutionize aquaculture in North America.

REFERENCES

A video recording of the webinar can be found here: www.aquaculture2020.org/reviews



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Catfish harvest in Noxubee County, Mississippi, United States of America.

Webinar: Regional Review on Status and Trends in Aquaculture Development in Latin America and the Caribbean - 2020

The latest review on aquaculture development in the Latin America and the Caribbean (LAC) region has been jointly prepared by Mr Carlos Wurmman, Ms Doris Soto and Mr Ricardo Norambuena, and this short article provides key highlights. A video recording of each webinar can be found here: www.aquaculture2020.org/reviews.

In 2018, aquaculture in the LAC region resulted in 3.1 million tonnes of fish, shellfish and molluscs (excluding seaweeds) worth USD 17.2 billion at first sale. Over the past five years, production volumes grew at an annual average of 5.6 percent per year compared with the world average growth rates of 4.2 percent. The sector contributed 17.9 percent to total fish production in the region compared with only 4 percent in 2000; if current trends continue, it is expected that LAC aquaculture production will reach 4.6 million tonnes in 2030.

Apart from some local exceptions, per capita seafood consumption rates in the region remain low at around 10 kg/year, which is approximately half of the global average. Except in Brazil, Colombia and Cuba, most aquaculture production is for export. Local eating preferences strongly favour poultry and pork, which are cheaper or more accessible than fish and red meat.

LAC aquaculture is highly concentrated in a few countries with the combined output from Brazil, Chile, Colombia, Ecuador and Mexico, representing 85 to 90 percent of total regional production. Salmonids and tilapia are the main finfish products, while whiteleg shrimp and Chilean mussels are the main shellfish products. Approximately 70 percent of farmed output is from a few introduced species, although over 90 species were farmed in 2018. The whiteleg shrimp, Atlantic salmon, Nile tilapia, Chilean mussel and rainbow trout, in decreasing order, together contributed 80.4 percent of regional production volume and 85.9 percent of value. Out of all species farmed, only 22 resulted in production of more than 5 000 tonnes in 2018. Technology gaps, poor research and development strategies, fragmented public policies, localized markets and marketing issues, and relatively high prices have all contributed to this low volume. The small island developing states (SIDS) face additional challenges, including inadequate national legal and policy frameworks and

support systems, limited expertise, high production costs due to the high cost of inputs and challenges with seed supplies, and biosecurity problems and natural disasters such as storms, floods and drought.

Marine aquaculture has been the dominant production environment in the region for the past 20 years, accounting for 70.1 percent of production in 2018. Freshwater aquaculture, with growth of 28 percent over the period 2013–2018, was mainly due to tilapia farming, while native species, mainly characins, generally showed stagnant or decreased production. Production models vary widely, with a concentration of large-scale companies in Chile, and primarily small-scale or medium-size operations in Brazil, Peru and several other countries. The smallest firms usually struggle to remain in business, mostly due to the lack of appropriate policies, technical support and capacity-building, as well as market conditions and accessibility.

Production prospects remain promising, but they need to be improved through better governance, the use of appropriate technologies, reinforced efforts to guarantee

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Opening remarks	Antonio Garza De Yta Secretary, Fisheries and Aquaculture, State of Tamaulipas, Mexico
Regional Review of Aquaculture in Latin America and the Caribbean - <i>Status, Trends and Options for the Way Forward</i>	Carlos Wurman Aquaculture Consultant, Chile Doris Soto Principal Scientist, Interdisciplinary Center for Aquaculture Research, Chile Ricardo Norambuena Center for Oceanographic Research, East South Pacific, University of Concepción, Chile

EXPERT PANEL DISCUSSION

Innovation and sustainability for inclusive aqua-culture development	Yahira Piedrahita Executive Director, National Chamber of Aquaculture, Ecuador
Main challenges for sustainable aquaculture in Small Island Developing States	Paul Gabbadon Director, Agricultural Development Bank, Trinidad and Jamaica
Narrowing regional gaps and fostering aquaculture alliances	Alicia Gallardo Director, National Fisheries and Aquaculture Service, Chile

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Moderator: **Alessandro Lovatelli**, Aquaculture Branch, FAO.

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environmental sustainability and social acceptance, as well as competitiveness and foresight to deal with climate and market changes.

Tilapia aquaculture has contributed significantly to food security in many countries of the region, but expansion of tilapia farming systems has been moderated in several areas owing to fears of negative environmental impacts. Farming of salmonids, which are also introduced species and produced mostly for export, has contributed significantly to livelihoods and employment, including for women and residents of remote locations, but has also resulted in significant negative impacts on ecosystem functions and integrity. A large proportion of cultured freshwater native species are consumed within the region, as is the case in Brazil and Colombia, where the majority of production comes from small- and medium-scale farms. These farms contribute directly to local food security, nutrition and livelihoods with potentially lower environmental impacts but often struggle to make profits and remain in business. Women have benefited from aquaculture in the region, especially in post-harvest and processing of export-oriented species such as salmon, shrimp, tilapia and mussels, and with other indirect employment opportunities and services. However, the impacts of aquaculture on employment have not been adequately documented.

Increasing climate variability and climate change are growing threats in the region. More frequent extreme weather events in the Caribbean and Central America are a threat to whole countries, including aquaculture facilities. Inland aquaculture is impacted by increasing air and water temperatures, decreasing freshwater availability and water delivery patterns. Droughts have significantly impacted tilapia culture in the Dry Corridor of Central America and Northeastern Brazil.

The aquaculture review finally focuses on a series of recommendations that require wider regional attention for the LAC aquaculture sector to grow and for the region to increase its overall contribution to world aquaculture production. A number of key recommendations focus on governance-related improvements, which include, among others, the need for solid and long-term sectoral development plans and related support policies, improved legislation, rules, and regulations. In addition, the promotion of a stronger country-to-country cooperation on technical exchange, industry diversification and equal support to both small- and large-scale aquaculture will likely foster investment and help the region gain a leading position among world aquatic food producers.

REFERENCES

A video recording of the webinar can be found here: www.aquaculture2020.org/reviews



Strengthening the adaptation capacity in the Chilean fishing and aquaculture sector to climate change, Caleta El Manzano-Hualaihué, Chile.

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Webinar: Regional Review on Status and Trends in Aquaculture Development in Sub-Saharan Africa - 2020

The article covers the status and trends in aquaculture development in sub-Saharan Africa (SSA) and the key messages presented during the webinar organized by the Fisheries Department of FAO on 28 October 2020. A video recording of the webinar can be found here:

www.aquaculture2020.org/reviews.

Because aquaculture plays a significant role in sub-Saharan Africa, its prioritization in many governmental policies and strategies has significantly increased and become linked with increased public understanding and appreciation. It is now considered a pathway to fulfil Agenda 2063 of the Africa Union as well as the Sustainable Development Goals (SDGs). Many small, medium and large enterprises have invested in the sector, which generates a variety of benefits in both rural and urban areas, including food security, livelihoods, employment, foreign currency income, and other socio-economic benefits. In the meantime, a review commissioned by FAO identified some challenges, such as tenure issues, cost of inputs, inadequate technologies, genetic and environmental integrity, biosecurity and access to financing that may impair the full expression of its potential.

Indeed, in spite of the attention and prioritization, aquaculture growth in the SSA regions has decelerated in recent years, with some exceptions, which indicates that technical and financial assistance from international partners needs to continue. Actually, aquaculture's contribution to global production has dropped from 0.75 to 0.62 percent between 2014 and 2018, although it has nevertheless grown significantly over the last decade, from 106 000 tonnes in 2000 to 709 000 tonnes in 2018, with a farm-gate value of about USD 1.68 billion.

Haile Gabriel Abebe, FAO Assistant Director-General and Regional Representative for Africa, noted that some of the causes of the slower growth of aquaculture in the region have to do with the “occurrence of seaweed diseases and infections, difficulties in accessing finance and technologies, and increasing production costs”. He also remarked that aquaculture was perceived as riskier than other agriculture sectors and that some commercial banks subsequently applied very high interest rates, up to a 35 percent interest rate for a loan with a very short grace period for payment. High interest rates pose a major challenge for the sector

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to take off, and Abebe further called upon financing institutions to rethink their approach.

Lewis Bangwe, Senior Agriculture Officer, African Development Bank, Zambia, also recognized the weak flow of financing opportunities in the aquaculture value chain, but shared the example of a USD 50 million Investment Aquaculture project. To better support the sector, the African Development Bank set up instruments to help address the lack of financing. Since several banks have criteria such as “scalable project sizes, preference for local entrepreneurs or where local communities have an equity stake, projects with potential to be transformative in nature, or in other words, combining primary production with value addition component benefiting smallholders throughout grower schemes”, Bangwe strongly recommended that public-private partnership projects with an agricultural infrastructure component figure as part of the project.

Leveraging aquaculture's productive potential, in the context of the Sustainable Development Goals, can prove

INTRODUCTION AND KEYNOTE

Welcome remarks	Matthias Halwart Head, Aquaculture Branch, FAO
Opening remarks	Haile Gabriel Abebe Assistant Director-General/ Regional Representative, FAO Regional Office for Africa
Regional Review of Aquaculture in Sub Saharan Africa - Status, Trends and Options for the Way Forward	Blessing Mapfumo Executive Officer Africa, World Aquaculture Society

EXPERT PANEL DISCUSSION

Past and future trends in aquaculture development and the role of regional collaboration	Michene Ntiba Principal Secretary, State Department for Fisheries, Aquaculture and the Blue Economy, Ministry of Agriculture, Livestock and Fisheries, Kenya
Opportunities and main challenges for women and youth employment in the aquaculture sector	Stella William Professor, Obafemi Awolowo University/ Founder, Nigerian Women in Agricultural Research for Development/ Vice President, Mundus Maris, Nigeria
Technology and innovation for sustainable aqua-culture development	Sloans Chimatiro Former Fisheries Executive Director of Southern African Development Community, Former WorldFish Centre Executive Director for Africa and African Union Inter-African Bureau for Animal Resources, Malawi
Roles of government and private sector in developing the aquaculture industry	Lewis Bangwe Senior Agriculture Officer, African Development Bank, Zambia

Q&A AND CONCLUSION

Question and Answer session	
Closing remarks	Matthias Halwart Head, Aquaculture Branch, FAO

Moderator: **Ana Menezes** and **Pierre Murekezi**, Aquaculture Branch, FAO.

a transformational force, as African economies recognize the critical need to diversify beyond land-based activities. Special programmes, including **addressing participation of women and youth, continental networking institutions to foster aquaculture and the implementation of the Blue Economy Agenda**, are also needed. Sloans Chimatiro, President, Pan-African Policy Research Network for Fisheries and Aquaculture, called for holistic approaches, specifically for national food security and nutrition policies to better take into account the role of aquaculture. He also highlighted the “need to address land tenure issues that on top of lack of financing, proper training and education for adoption of technologies and innovation, further causing difficulty for youth entry in the sector, trade and marketing issues, applicable policies based on the ground reality”.

Professor Michene Ntiba, Principal Secretary, State Department for Fisheries, Aquaculture and the Blue Economy, of Kenya, recalled the intertwined objectives of the SDGs with the Blue Economy paradigm and how aquaculture fits in with the various objectives to achieve better production, a more sustainable aquatic environment and better conserved terrestrial ecosystems. The sector plays a big role in the Blue Economy regarding its power to provide African citizens with better nutrition and better life, even in remote areas. Its role in **mitigating and reducing disaster risk and building resilience must be highlighted and mainstreamed in aquaculture and fisheries development strategies**.

For aquaculture to realize its full potential, the SSA region also needs to address a combination of overarching factors limiting its development so far, such as ineffective development approaches, weak governance frameworks, underdeveloped value chains, low availability and high cost of key production inputs, aquatic disease and climate change. Many successful aquaculture business stories throughout have begun to indicate the way forward, but previous constraints are now compounded by the impacts of the COVID-19 pandemic. Haile Gabriel Abebe thus emphasized the need of consultative and urgent actions to reverse this negative trend. Science, technology and

innovation are needed, as well as the adoption of enabling policies and a regulatory framework to promote sustainable intensification and innovative value chains.

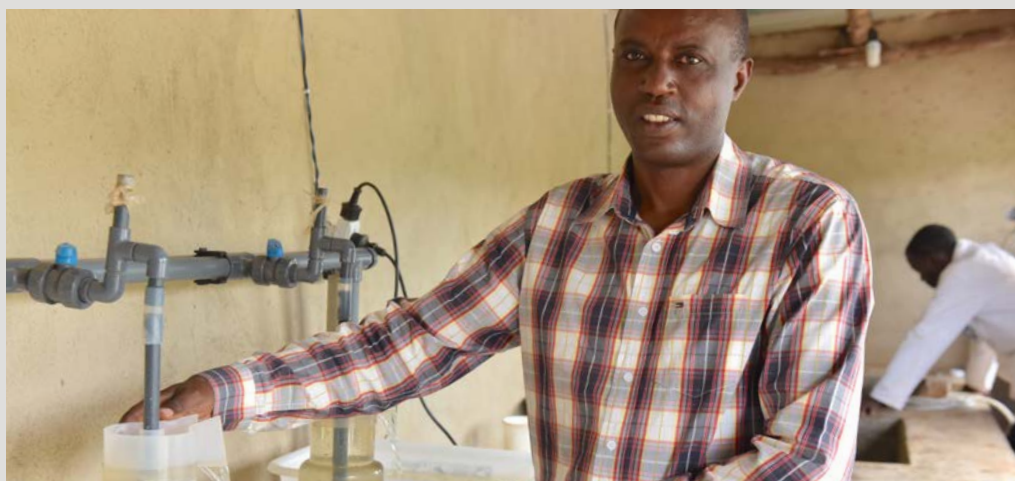
Political will and stakeholders’ awareness and willingness to be active participants are key for the development of the continent, in particular in the agricultural sector. A non-negotiable element in aquaculture development, at national or regional level, is the participation of all stakeholders, including **youth and women, throughout the decision-making processes, development plan and its implementation**. Professor Stella William, of the Nigerian Women in Agricultural Research for Development, issued a passionate statement on this matter and called upon “women and youth to network with other peers within and outside the continent, to make aquaculture a science-based profession and enterprise”. **Research supported by the public and private sector** is also needed to boost the sector.

Blessing Mapfumo, the lead author of the regional review and Executive Officer African Chapter of the World Aquaculture Society, and FAO co-authors Ana Menezes and Pierre Murekezi agreed with the panel members on the various weaknesses, challenges, strengths and opportunities. They recalled that such issues and benefits have also been emphasized in national, regional and international forums, especially during the Committee on Fisheries, the COFI Sub-Committee on Aquaculture, the Committee for Inland Fisheries and Aquaculture of Africa and the Aquaculture Network for Africa, among others.

“Africa aquaculture needs business and development modules, including sustainable intensification, adequate frameworks and innovative value chains that are tailored to national realities rather than adopted from other regions”. Haile Gabriel Abebe (Assistant Director-General/Regional Representative, FAO Regional Office for Africa).

REFERENCES

A video recording of the webinar can be found here: www.aquaculture2020.org/reviews



Aquaculture farmer at Mulindi, Kigali, Rwanda with a tilapia incubator.

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New Opportunities for Aquaculture Development in The Gambia

Annual fish consumption per person in The Gambia has been fluctuating between 25 and 30 kg, well above the global average consumption for the last decade¹. With natural fisheries resources under full exploitation², the Gambian Government is promoting aquaculture production in order to stay above the global average with a rapid growing population.

In response to the challenges faced in capture fisheries, the Government of The Gambia has set aquaculture as one of the priority intervention sectors for creating decent jobs (especially for youth and women), reducing poverty, improving productivity and boosting economic growth.

At the request of the Gambian Government, FAO implemented the project entitled *Support to enhancing the capacity of youth and women for employment in aquaculture*, under its Technical Cooperation Programme (TCP/GAM/3603), from 2016 to 2019. The project contributed to Africa's Blue Growth Initiative; its main goal was to improve fish supply for food and nutrition through more efficient and sustainable use of aquaculture resources by training



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The Jahally Aquaculture Center was rehabilitated under the FAO project, and now is able to provide adequate fingerlings and locally produced fish feed to the country's aquaculture farmers.

farmers, including young men and women, and encouraging them to implement innovative aquaculture production technologies.

Various attempts had been undertaken previously to develop the aquaculture sector in the country, but adoption by fish farmers and the private sector was hampered not only by the lack of quality fingerlings and fish feed but also by the lack of technical skills of potential farmers and government officers.

The project's objective was to establish a solid and functioning foundation for sustainable provision of and

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1. FAO Fisheries and Aquaculture Country Profile of The Gambia (available at: www.fao.org/fishery/facp/GMB/en).

2. CECAF Working Groups for Demersal and Pelagic Fisheries Resources.

access to good quality fingerlings and feed and the transfer of technical and managerial expertise to farmers and officers for aquaculture to develop effectively and sustainably.

One of the tasks of the project was to rehabilitate an old hatchery, originally constructed with donor support in 2008–2009, which continued to be in use until 2013. The relevant ministry at the time organized overseas training of staff members in the different disciplines of aquaculture during which the hatchery became dysfunctional. The project rehabilitated and modernized the hatchery for tilapia and catfish and purchased two fish-feed manufacturing units, one for the Jahally hatchery and another one for a well-established youth group in Koloro, on the South Bank of the Gambia River. The project also provided shelter for these units and connections to water and power grids.

The hatchery and feed plants provided the relevant ministry with the means for fingerling production and feed manufacturing. In 2020, the hatchery was handed over to the Government and inaugurated by the Ministry of Fisheries, Water Resources and National Assembly Matters. It took the ministry considerable time upon conclusion of the project to complete the final works at the hatchery, which delayed the hatchery operations considerably. Consequently, some fish farmers are waiting for farm inputs with impatience to stock their fish ponds with quality fingerlings.

During the implementation of the TCP project, the Gambian Government requested FAO to assist in preparing a large fisheries and aquaculture project to be financed by the Green Climate Fund (GCF) with emphasis on further support to the emerging aquaculture sector. In 2021, a decision will be made by the GCF Secretariat (during its October 2021 Board Meeting) whether the project will be funded or not.

The proposed project aims at producing sufficient quantities of fish to maintain the same level of consumption for a



Various fish, including farmed catfish, being sold at market, an important income-generating activity for some Gambian women.

growing population, and for this purpose additional hatchery capacity may be required. In the light of climate change, the proposed project will assist in providing assistance to integrate fish in rice fields, promote growth of catfish in high-density fish tanks, resort to climate proofing existing fish ponds, and strengthen the oyster and cockle culture in mangrove forests and on tidal flats.

The proposed project will focus on on-the-job training of fish farmers through the Fish Farmer Field Schools approach at a demonstration farm, for which the Jahally hatchery has been selected. The hatchery will require simple modifications to provide on-site training capacities. Additionally, the proposed project will supply fingerlings and feed for rice-and-fish activities; fingerlings, feed and processing kilns for catfish culture in tanks; tools and equipment, fingerlings and feed for fish ponds; and toolkits and canoes for oyster and cockle collection by women's associations.

This intervention is expected to contribute greatly to the development of aquaculture in the country, and more importantly, it will help improve the socio-economic status of beneficiary communities, especially for youth and women, through employment creation, income generation and increased food production.



Aquaculture pond in The Gambia.

FAO Supported Investigation of COVID-19 Impacts on Aquaculture in China



© Freshwater Fisheries Research Center

Field staff interviewing channel catfish farmer.

The COVID-19 pandemic has seriously impacted the overall agriculture sector and the stakeholders along the value chain since its outbreak. FAO has taken actions to support its Members to effectively address the impact of the pandemic, including assessing the specific damages to the sector and recommending an appropriate strategy and actions to mitigate the impact and speed up the post-pandemic recovery of the sector. Largely due to the features of the aquaculture sector in China, notably a heavy dependence on distant markets and external inputs (e.g. imported), the damage to the aquaculture sector caused by the pandemic is more severe than in other food production sectors.

China is the largest producer of aquaculture products, contributing 52 percent of the global production. As a well-established market-oriented sector, Chinese aquaculture depends heavily on the normal functioning of all the links along the value chain. After the first identification of COVID-19 in December 2019 in Wuhan, China, containment measures were soon enforced to prevent the spread of the epidemic, including the complete

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lockdown of Wuhan City and the nationwide restriction of public transportation, personal travel and shutdown of markets for fresh and live agricultural products and related service sectors. These measures impacted production and marketing of aquaculture products and the related supporting sector in China much earlier than the rest of the world.

In order to understand the impact of COVID-19 on the entire aquaculture value chain and what strategy and measures have been taken to support the stakeholders to address the impact of the pandemic on the sector, FAO supported the Freshwater Fisheries Research Centre (FFRC) in carrying out a preliminary investigation. The investigation focused on channel catfish (*Ictalurus punctatus*) farming in Hubei Province and tilapia farming (*Oreochromis* spp.) in Guangdong Province. It was expected the investigation would provide good information for FAO and its Members to better understand the impact of the pandemic on aquaculture with a view to developing

appropriate strategies to cope with the pandemic and similar risks in the future.

The investigation involved questionnaires and analysis of data from other sources, which focused mainly on the impact of COVID-19 on major links along the well-established value chains. In addition, the study also tried to capture the government interventions and measures taken by different actors along the value chain to minimize the damage of COVID-19 and support the recovery of the sector. In order to comprehensively assess the impact of the pandemic on different links of the value chain, ten specific questionnaires were designed for survey of all the stakeholders along the supply chains, which included growout fish farmers, seed producers, fish processors, fish traders and feed companies engaged in the catfish sector in Hubei Province and the tilapia sector in Guangdong Province. The questionnaires attempted to assess the immediate impact of the pandemic during the period featuring strict enforcement of pandemic control measures (January–March 2020), post-effect and recovery after strict pandemic control measures were lifted (April–July 2020), and projection of impact on sectoral performance for the entire year of 2020. The survey was carried out by the field staff from local aquaculture service agencies during July–August 2020 with technical support from the FFRC team.

A total of 45 questionnaires were completed, with some important findings summarized in Figures 1 and 2.

The investigation results indicated a significant difference in the impact of the pandemic on different stakeholders in two subsectors.

- The farmed catfish sector in Hubei Province has been more severely impacted by the pandemic than the farmed tilapia sector in Guangdong Province.
- Catfish farmers and fish traders are most severely impacted by the pandemic. Feed companies and fish processors were less impacted.

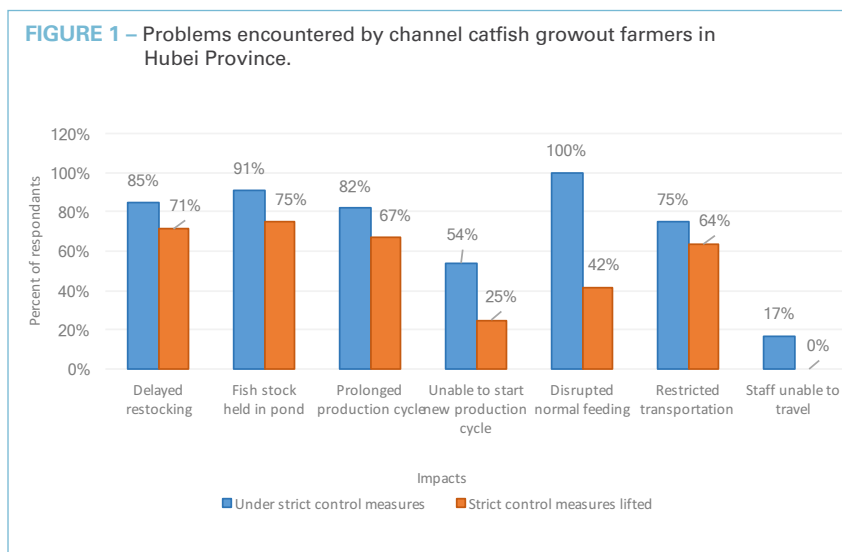
- International trade of the two farmed commodities was more seriously impacted than domestic sales.

The investigation identified the most significant specific impact of the pandemic on production and operation at different value chain links, which include:

- Holding of fish stocks in ponds was due to delayed harvesting, which hindered the next farming cycle.
- Poor fish growth resulting from management interruptions (for example irregular feeding) was due to certain epidemic containing measures.
- Cut-off supply to fish traders, which significantly reduced international orders and sales.
- Financial difficulty in operations was due to increased costs and reduced or delayed revenue.

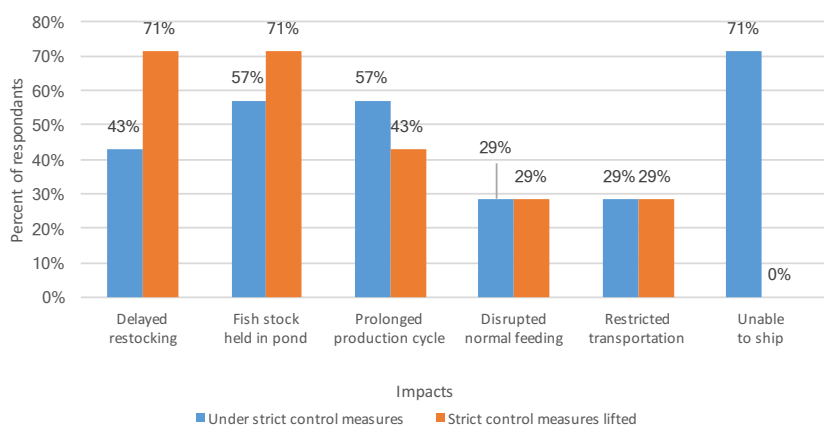
The investigation also covered the impact of the pandemic on the livelihood of households engaged in the value chain, which significantly reduced income due to lower payment and business revenue (for example the income of all catfish seed producers reduced by more than 50 percent) and occasioned family financial difficulty (30–40 percent of surveyed farmers). Special attention was paid to the additional impact on women associated with the sector, which mainly included the increased burden of caring for and educating children and extra pressure to maintain the basic living conditions of the family.

The investigation showed that sectoral actors adopted practical measures to mitigate the loss caused by the pandemic, which included prolonging the production cycle and reducing the potential loss of products and marketing products in unconventional ways, such as direct marketing through e-commerce. The government took appropriate strategies and interventions to support a basic living standard for people and support the normal farm operations during the lockdown period, which included providing “green passages” for transporting food commodities and key production inputs, subsidies to purchase fish products by processing and trade companies, and financial assistance to households with difficulty in managing basic living expenses.



Based on the projection of the surveyed respondents, the yield of farmed catfish and tilapia would be about 20 percent lower, the production cost would increase by more than 10 percent, and the profit would be 20–25 percent lower in 2020. The sales of farmed channel catfish and tilapia would be 20–30 percent lower in 2020 than the previous year. However, the prediction made by the experts leading the national programme on the industrial chain for tilapia and channel catfish on the production and sales of farmed channel catfish and tilapia in the whole country is more optimistic due to anticipation of significantly increased culture areas in the second half of the

FIGURE 2 – Problems encountered by tilapia growout farmers in Hubei Province.



future. Recommendations included strengthening the disaster early-warning system and local capability of risk mitigation, supporting development of modern trade/marketing mode for aquaculture products and needed infrastructure, and promoting innovation and transformative changes in aquaculture technology and production systems for better resilience and preparedness for disasters. Specific innovations could include changes to the cropping system to avoid production seasonality, concentrated harvesting and marketing, better organization of farmers to support collective efforts in coping with hazards, e-commerce technology and infrastructure, and remote manipulation of culture environment and management. With regard to improvements in the social security and protection system for the aquaculture sector, specific recommendations include the full inclusion of farmers into the local social security systems, scale up of the pilot aquaculture insurance scheme, and dedicated mechanisms and systems for disaster assistance.

year to compensate for the loss of production during the pandemic period.

As an important output of the study, a set of strategies and measures were recommended for supporting the aquaculture sector and stakeholders in the value chain to cope with the pandemic and other similar risks in the



Tilapia fingerlings ready for stocking in growout ponds.

Climate Change Adaptation in Fisheries and Aquaculture in the Central Asia and Caucasus Region

A virtual webinar on climate change adaptation in fisheries and aquaculture in the Central Asia and Caucasus (CAC) region was organized on 23–24 June 2020 in two sessions in cooperation with Bogazici University's Center for Climate Change and Policy Studies. The webinar was supported by the project "Capacity Building for Sustainable Fisheries and Aquaculture Management in Central Asia, Azerbaijan, and Turkey (FISHCap): GCP/SEC/013/TUR", implemented under the FAO-Turkey Partnership Programme on Food and Agriculture and funded by the Government of the Republic of Turkey. The virtual workshop aimed to provide an overview of the status and impacts of climate change on aquaculture and fisheries in Central Asia and the Caucasus and to discuss potential adaptation and mitigation activities. The webinar was originally scheduled for March 2020, but was postponed due to the COVID-19 pandemic.

The target audience of the webinar included government staff, decision-makers in fisheries and aquaculture management, academics and researchers involved in climate change issues, and fish farmers and representatives of fishery/fish farming organizations. More than 60 experts participated in the workshop, hailing from Azerbaijan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkey, Turkmenistan and Uzbekistan.

The following are the key messages from the webinar:

- Climate change is an increasing global challenge that requires urgent, coordinated and consistent action.
- Climate change is increasingly affecting the fisheries and aquaculture industry. Both direct and indirect climate impacts include changes in the range and productivity of targeted species, their habitats and food webs, as well as the impacts on fishery and aquaculture costs and productivity and fishing community livelihoods and safety. Climate change could have either positive or negative impacts on aquaculture, which might arise from direct and indirect effects on the natural resources that aquaculture requires, such as land, water, feed, seed and energy.
- Climate change is posing considerable risks to aquatic ecosystems and to social and economic systems in the Central Asia and Caucasus (CAC) region. Central Asia is particularly vulnerable to climate change, particularly because of the arid nature of the region.
- Understanding the perceptions of aquaculture stakeholders regarding the impact of climate change on aquaculture is important to develop adaptation/mitigation policies.
- Lack of long-term historical climate data in most cases makes it difficult to project impacts from climate change.
- Historical meteorological, hydrological and limnological

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data can be used as input for improved impact evaluation for fisheries and aquaculture. However, current knowledge on the potential climate change impacts on aquaculture in the region is inadequate.

- There have been several studies on the impact of climate change on water resources in the Central Asian countries. Climate change would pose remarkable risks to fisheries and aquaculture in the CAC region, as indicated by growing numbers of reported climate projections and scenarios. It is known that a significant number of lakes in Asia, such as the Aral Sea, have considerably shrunk in size, while others are in danger or have fully disappeared. Evidence indicates unusual water level fluctuations in large waterbodies.
- Climate change could have economic impacts on the fisheries and aquaculture sectors in the region, including the producers, input suppliers, support industry, consumers and other stakeholders along the value chain. However, it was stated that mitigation options and strategies exist for the direct and indirect climate impacts on inland fisheries and aquaculture, including culture-based fisheries. Some of these strategies are increased water usage efficiency, use of recirculation systems in aquaculture production systems, innovative technologies, and integrated water resource management and planning. The culture of low-trophic-level species would contribute to climate change mitigation.

Conclusions and future prospects

Climate change is one of the biggest global challenges with an alarming upward trend. The CAC region is projected to be significantly affected by climate change with implications for many communities and industries, including fisheries and aquaculture, but the region lacks historical climate data. The impacts of climate change are expected to be more intense in developing countries due to the limited capacity and high economic and social costs of adaptation. Renewable energy and green technologies could help countries to mitigate climate change. The cost of climate action will be significant, and the actions will require a coordinated public-private sector response. In the context of the CAC region, further studies/research, on the following topics would provide useful information for the climate actions both at national and regional levels:

- climate change impacts on aquatic ecosystems, species, and water resources and their flow regimes;
- ecological restoration, biodiversity conservation and ecosystem connectivity;
- farming of species that are tolerant of a wide range of environmental conditions and stressors;
- farming of low-trophic-level species; and
- water-smart, ecofriendly aquaculture productions systems.

SEE ALSO

FAO. 2020. *The State of World Fisheries and Aquaculture* (SOFIA): www.fao.org/fishery/sofia/en

Food Safety for Fisheries and Aquaculture Products in the Central Asia and Caucasus region: Webinar

Food safety remains a major concern for the fisheries and aquaculture industry, and it is a critical component for ensuring food and nutrition security worldwide. The production and consumption of safe food are central to any society, and they have a wide range of economic, social and, in many cases, environmental consequences. The issue of food safety is even more important in view of the growth in international fish trade, which has undergone tremendous expansion during the past three decades (FAO, 2020). Expansion of the food industry and food distribution systems across borders and continents has required the development of quality assurance systems to support business-to-business contractual agreements and verification of conformity of food supplies with the specifications. Simultaneously, the development of bilateral, regional and multilateral trade agreements has brought about changes in national and supranational food control systems to harmonize requirements and procedures. The efforts of the industry and food control authorities were not harnessed in a synergistic way until the advent of regulatory hazard analysis and critical control points (HACCP) food control systems. Much still needs to be done to promote complementary systems that will enable the control and prevention of food safety hazards at the source and along the supply chain and decrease reliance on end-product sampling and testing (FAO, 2020). Adequate laboratory infrastructure is a very important part of this process and is required to support monitoring, surveillance and enforcement activities.

A regional webinar was organized virtually on 29–30 September 2020 under the project “Capacity Building for Sustainable Fisheries and Aquaculture Management in Central Asia (FISHCap): GCP/SEC/013/TUR”, implemented under the FAO-Turkey Partnership Programme on Food and Agriculture (FTPP II). The main objectives of the webinar were to (i) provide the participants with the basics of sampling methods, laboratory management and accreditation processes of food control laboratories; and (ii) analyse institutional capacity for food safety for fishery and aquaculture products in the region through a questionnaire sent to countries before the event.

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The webinar was attended by more than 60 experts from Azerbaijan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkey, Turkmenistan and Uzbekistan. The webinar targeted policy-makers, researchers, fish farmers, representatives of fishers’ association and companies, as well as ministerial staff involved in food policy, food safety of aquatic products, quality assurance, and testing of fisheries and aquaculture products for food safety and quality control.

The main topics delivered on the first day were hazards in fishery and aquaculture products; Codex Alimentarius and the code of practice for fish and fishery products; international requirements, regulations and standards associated with food safety and quality for fisheries and aquaculture products (the European Union and United States of America); Eurasian Economic Union requirements, regulations and standards; challenges for handling and processing of fishery and aquaculture products; and how to reach international markets. The second day included presentations on Turkey’s food safety regulatory system, including food control laboratories, laboratory quality management systems and accreditation processes.

The following participating countries responded to the questionnaire survey request: Kazakhstan, Kyrgyzstan, Tajikistan, Turkey and Uzbekistan. The following are key findings from the survey.

- There is an effective food safety regulatory framework in the five responding countries. The responding countries stated that they each have a competent authority for food safety inspection for fishery and aquaculture products. These authorities each have a food safety regulatory framework that supports or strengthens government control with respect to food safety for fisheries and aquaculture products for local consumption, a national accreditation body and an accredited laboratory to support the country’s food safety inspection system.
- All the responding countries are, to varying degrees, exporters of fisheries and aquaculture products. The top exporting country is Turkey, with a diverse range of products targeting many countries. Kazakhstan, Kyrgyzstan and Uzbekistan mostly export to neighbouring countries and the Russian Federation. All the responding countries also import fisheries and aquaculture products and have border inspection posts.
- Tajikistan and Turkey reported that they have expertise in import risk analysis for fisheries and aquaculture products.

- Responding countries have a notification system for food and feed where rejections and detentions of imported fishery and aquaculture products are reported.
- Among the responding countries, Turkey is the top producer of fishery and aquaculture products.
- Due consideration is given to fisheries and aquaculture in food safety policy and planning. Each country has a designated agency responsible for national food safety policy and planning.
- In the surveyed countries, there is a strong food safety regulatory framework for the hygiene of foodstuffs and foods of animal origin. The respective legislation includes specific regulations for fisheries and aquaculture products. Furthermore, the legislative framework includes Codex standards.
- In all responding countries there are formal degree and informal training programmes in relation to food safety.
- Only Uzbekistan and Tajikistan provided a response to the question on the main food safety challenges for fisheries and aquaculture products. Key challenges reported by these countries include international standards, infrastructure, technical capacity and emergency preparedness (for example COVID-19).

Conclusion and recommendations

- Although countries in the region have food safety regulatory frameworks, these frameworks need to be enhanced, in particular regarding laboratory analysis, market control and hygiene requirements for fisheries and aquaculture products.
- The trade of fisheries and aquaculture products plays an essential role in boosting fish consumption and achieving global food security by connecting producers with distant markets for which local supply may otherwise be insufficient.
- Common and recurring priorities in the Central Asia and Caucasus region include developing risk-based inspection systems, strengthening laboratory capacities, improving scientific and risk-assessment capacities as the basis for decision-making on food safety, improving food import and border control, and coordinating efforts to address issues such as antimicrobial resistance that require a multisectoral approach.



Fish displayed on ice at market.

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Carp Farming in Eastern Europe and Central Asia: Webinar

Carp, barbels and other cyprinids are the top species group cultured worldwide, accounting for a quarter of global aquaculture production volume (29 million tonnes) and value (USD 62 billion) in 2018. This group includes 40 species farmed in 93 countries, while China is by far the major producer (FAO, 2020). The top four cultured carps are grass carp, silver carp, common carp and bighead carp, which are marketed mostly domestically as relatively low cost. Common carp are among the key fish species farmed in the Europe and Central Asia region.

A webinar was organized as part of the project “Capacity Development for Sustainable Fisheries and Aquaculture Management in Central Asia, Azerbaijan and Turkey” (FISHCap), which was developed under the FAO-Turkey Partnership Programme. The two-day technical event was conducted virtually. The webinar was organized by FAO in cooperation with partners, including the Freshwater Fisheries Research Centre of Chinese Academy of Fishery Sciences, Wuxi, China; the Research Institute for Fisheries and Aquaculture, based in Szarvas, Hungary; Network of Aquaculture Centers in Central and Eastern Europe; the Turkish Ministry of Agriculture and Forestry; and the Romanian Fish Farmers Association.

The aims of the webinar were twofold: (i) to acquaint participants with principles and techniques of carp farming in Eurasia; and (ii) to share knowledge on modern and innovative technologies in carp farming. More than 100 participants from Azerbaijan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkey, Turkmenistan and Uzbekistan attended the webinar, including experts, farmers, researchers, representatives of fishers/fish farmers associations, and companies and ministerial staff.

The webinar covered the following topics:

- status and development trends of carp aquaculture in Central Asia and Eastern Europe;
- induced breeding and nursery management of carps in China;
- Broodstock Management and Genetic Improvement of Carp, a Hungary Case Study;

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Common pond design for common carps in Central Asia.

- carp farming in China: technology and dissemination;
- farmer’s organization: capacity and support to small-scale farmers;
- ornamental fish farming – Turkey case study;
- carp nutrition and feeding;
- carp farming technology extension in China: role of aquafeed companies; and
- health management in carp farms.

During the exchange and discussion, it was noted that the main production systems in Europe for common carp are pond culture and polyculture along with other carps. Often the ponds are part of a multifunctional space, where the surrounding area is used for recreational activities, or are connected with agritourism, farm stays, education activities, entertainment or restaurants. The ecosystem services of these multi-use farms are also highly important, for example as critical habitat for native waterfowl. Overall, the added value is often far higher than the value of the fish production, up to ten times more. Relevant policy and capacity development activities should recognize the multifunctional nature of these farming systems, acknowledging consumer demands, opportunities for environmental restoration and conservation, and recreational activities. To this effect, partnerships, research and development, and regional-international cooperation are key to success, as will be the involvement of all stakeholders, specifically women and youth.

SEE ALSO

FAO. 2020. *The State of World Fisheries and Aquaculture (SOFIA)*: www.fao.org/fishery/sofia/en

EIFAAC Research Supports Regional Solutions for Freshwater Aquaculture of Europe

Established in 1957, the European Inland Fisheries and Aquaculture Advisory Commission (EIFAAC)¹ is a pan-European platform intended to provide science-based data and advice on a wide range of issues facing the inland aquatic resources of Europe. The overarching mission of EIFAAC is to promote the long-term sustainable development, utilization, conservation, restoration and responsible management of European inland fisheries and aquaculture resources and to support sustainable economic, social and recreational activities enabling these goals. The Commission currently operates under a project-oriented structure that was approved by the 27th Session, which was deemed a more efficient structure for delivery of EIFAAC goals. A Technical and Scientific Committee (TSC) was established in 2010 to accommodate the project structure. Proposals for EIFAAC projects may be developed by the TSC, a member, a donor, a partner organization or an independent partner institution.

As of December 2020, there were six active EIFAAC projects:

- **Management/Threat of Aquatic Invasive Species in Europe.** This project organized the conference “Following the Freshwater Invasives – Networking for Strategy (FINS),” followed by three symposia: FINS Symposium in Ireland (2013); FINS-II in Croatia (2016); and FINS-III, which will be held in Hungary (2022). The project has produced several publications.^{2,3,4}
- **Monitoring the Performance of Fish Passes; European Committee on Standardization (CEN) Standard.** The aims, scope and contents of the draft standard were presented at the German Federal Institute of Hydrology workshop on standardizing fish passes in Koblenz on 7 June 2018. The finalized standard was submitted for vote in February 2019.
- **Developing Advice on Sustainable Management Actions on Cormorant Populations.** A cormorant symposium was held in Lillehammer, Norway, 9–10 October 2018. This project produced a publication.⁵
- **Joint EIFAAC/ICES/GFCM Working Group on Eel.** The report of the Working Group was published by the International Council for the Exploration of the Sea (ICES) on its website.
- **Workshop on Citizen Science in Fisheries.** A workshop was to be scheduled in Finland in November 2020 but was cancelled due to the COVID-19 pandemic. The topic has been included in the next EIFAAC Symposium.
- **EIFAAC Symposium on Food Safety and Conservation in Inland Fisheries and Aquaculture,** which will be hosted by the Government of Ireland, Killarney, Ireland, 20–21 June 2022.

In 2020, the TSC called upon its members to propose new projects based on their priorities in inland fisheries and freshwater aquaculture. The following five project themes were approved by the Management Committee in December 2020; virtual meetings with experts from participating countries were held in the first quarter of 2021:

- Theme 1:** The problems and challenges of climate change and its impact on inland aquatic resources and fisheries of Europe.
- Theme 2:** Interactions of inland fisheries and aquaculture with other freshwater uses: conflict identification and potential benefits.
- Theme 3:** Environmental DNA in freshwater fisheries, current status and future possibilities – a review.
- Theme 4:** Determination of economic, cultural and social values of inland fisheries and freshwater aquaculture in Europe.
- Theme 5:** Fish stocking guidelines, including general principles, best practices, economic aspects, interaction with natural stocks and safeguarding biodiversity.

As EIFAAC is an advisory regional fisheries body under Article VI of the FAO constitution, project funding is through country or donor contributions, with FAO providing support for publication and dissemination of research findings.

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Development of a Management Plan for the Lagoon of Bizerte in Tunisia

Aquaculture in the Mediterranean Sea represents a key sector to increase fresh and marine protein production. Growing demand for fish and fishery products, coupled with the quick development of new aquaculture technology, stimulates the use of marine and coastal space to develop the sector. The coastal lagoon of Bizerte, with a surface area of 150 km², is located in the northwest of Tunisia. The water exchange of the lagoon is essentially ensured by the Mediterranean Sea, Lake Ichkeul (biosphere reserve, natural world heritage and Ramsar site), and water inputs from the Bizerte hydrological basin. Characterized by high biological productivity, this lagoon acts as nursery for several marine species, as well as a maturation site of adults and feeding area for many high-value species (for example European eel, seabass and seabream).

Although the Bizerte lagoon has a strong fishery and bivalve aquaculture tradition, the economy of the region is mainly based on industrial activities (for example oil refining, steel and cement production) and agriculture. Therefore, urbanization and nearby industrial factories alongside the high concentration of agriculture around the whole lagoon induce eutrophication and environmental degradation. Furthermore, the absence of a coastal development plan has generated increasing conflicts between mussel/oyster farmers and artisanal fishers.

As natural biofilters, shellfish provide great benefits to the lagoon environment, such as water purification and act as indicators of water quality. The implementation of this type of culture in water basins with a high eutrophic load is key to mitigate the negative effects of excess nutrients (especially harmful algal blooms, increase in opportunistic species and turbidity).

Identification of allocated zones for aquaculture (AZAs) is considered an essential step towards the sustainable development of aquaculture, under a blue growth perspective, and thus has a special role to play in marine spatial planning.

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The General Fisheries Commission for the Mediterranean (GFCM) of the Food and Agriculture Organization of the United Nations has been actively supporting national capacity development towards AZA implementation. In this context, technical support was provided to Tunisia and neighbouring Mediterranean countries. Special attention was paid to the use of tailored models according to the specific needs of national stakeholders.

A joint effort

In collaboration with the FAO Subregional Office for North Africa in Tunisia, the Ministry of Agriculture, Water Resources and Fisheries and the University of Alicante (Spain), the GFCM launched a set of activities to identify suitable zones for aquaculture. Necessary funds were mobilized by the GFCM in order to evaluate the lagoon's carrying capacity with the aim of proposing AZAs for shellfish.

In the same context, the FAO Subregional Office for North Africa has launched a Technical Cooperation Programme (TCP) titled "Elaboration of a management plan for the Bizerte lagoon in Tunisia for territorial socio-economic development", in response to the Tunisian Government's request. This new project, along with GFCM planned activities, will effectively contribute to improving the management of this waterbody through a better definition of spatial use of the several economic activities running in and around the lagoon.

Allocated zones for aquaculture

An allocated zone for aquaculture is a suitable area for aquaculture development, where the activity has priority over other sectors and users. AZAs are identified through a zoning process within marine spatial planning, which is based on a participatory approach. In this way, the zoning process incorporates environmental, socio-economic and administrative parameters and involves the coordination among different stakeholders. Besides the implementation of AZAs, the management plan and environmental monitoring programme contribute to minimizing conflicts between coastal users while supporting the generation of employment opportunities, greater food security and enhancing aquaculture social acceptability.

Looking ahead

The activities launched by the GFCM aim at improving the management of the Bizerte lagoon. Furthermore, the implementation of AZAs for shellfish farming and the estimation of the carrying capacity facilitate the selection of the most suitable sites through a participatory approach while taking into full consideration social and environmental criteria.



Interaction between small-scale fisheries and longline mussel farming in the lagoon of Bizerte, Tunisia.

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The TCP project planned activities include: (i) the elaboration of best aquaculture practices for fish and shellfish farming; the inventory of small-scale fisheries and mapping of fishing areas; (ii) the zoo-sanitary classification of the lagoon; (iii) the promotion of the establishment of fisher organizations and assisting their members in capacity development; (iv) the increase in production capacity of the shellfish hatchery of the Technical Center of Aquaculture in Bizerte; and (v) the development of a certification schema for fishery and aquaculture products of the lagoon. At the end of the project, a full-fledged proposal for the implementation of the lagoon management plan will be elaborated for funding.

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The Fishery and Aquaculture Sectors Affected by the COVID-19 Crisis in the Maghreb

According to five national reports prepared by the FAO Subregional Office for North Africa, the Maghreb fishery and aquaculture sectors experienced a significant decline in activity in 2020 due to the COVID-19 pandemic. The reports are based on a survey conducted in four Maghreb countries – Algeria, Mauritania, Morocco and Tunisia, which all experienced a drop in production and income in 2020. As stated by Philippe Ankers, Coordinator of the FAO Subregional Office for North Africa, “*The pandemic has caused substantial disruption in fisheries and aquaculture in the Maghreb, as production and supply chains have been affected and demand has suffered from restrictions aimed at slowing down the transmission of the virus*”.

The qualitative survey conducted between March and August 2020 focused on questionnaire-style interviews, with more than 200 respondents involved in the fisheries and aquaculture sector. The participants included representatives of professional organizations of fishers, fish farmers, staff from central and local administrations, and workers from processing units, transport and distribution. Almost 79 percent reported a drop in production due to blockage of certain activities and disruption caused by the pandemic.

To ensure food supply during the crisis, some of the countries in the study provided exemptions from lockdown measures for vital sectors. This was the case for the aquaculture sector, as more than 65 percent of the interviewees reported fully working aquaculture farms in their regions regardless of the strict general lockdown. Despite those exemptions, FAO found an 8 percent drop in fishery production and 34 percent in aquaculture for the first three quarters of 2020 compared to the same period in 2019.

Mitigation measures adopted by governments to limit the spread of COVID-19 impacted every link in the supply chain, from production to processing, transport and even marketing. These sectors have been weakened by the limitation of fishing at sea, the closure of markets and places of sale, the interruption of transport and the

closure of borders. This has led to an unprecedented collapse of market indicators (demand, supply, and price), as well as an upheaval in the modes of production and consumption of fishery products. Nearly a quarter of respondents estimated the decline in their income by 20 to 40 percent caused by lower production, while more than a third predicted a financial loss of between 40 and 60 percent for 2020.

Although the curfews in Algeria, Morocco and Tunisia did not directly affect workers in the fishing and aquaculture sector, many businesses and individuals suffered from a drop in local and international demand owing to the closures of restaurants and hotels. The report notes that, in response to the crisis, some countries have allocated financial and fiscal support as well as transport services to stakeholders in the fisheries and aquaculture sectors. Such methods were particularly active in the processing sector, intended to minimize sudden losses, maintain jobs and promote post-COVID-19 recovery. In Morocco, for example, the government encouraged public investment in fishery and aquaculture projects.

The report also showed that consumption shifted towards canned, frozen and processed fish at the expense of fresh products, especially at the beginning of the pandemic. This consumer behavior impacted fish demand and prices, and 67 percent of the respondents even labelled marine products as luxury products, non-essential in a time of crisis. This may have a long-lasting impact, as consumers may also need time to return to pre-crisis levels of out-of-home consumption. Finally, the economic downturn caused by the pandemic and the subsequent reduction in the purchasing power of consumers could harm demand in the medium and long term. Under these circumstances, the recovery in demand is likely to be slow and difficult to predict.

The pandemic has also brought to light problems that already existed in the sector. The people interviewed encourage the promotion of information platforms with early warnings on the state of the market, as well as the sale of surplus production and unsold fish products to hospitals, schools and other institutions. They also call for the diversification of service providers, the encouragement of alternative marketing measures, such as online sales, and finally the simplification of administrative procedures.

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Feeding operations in a floating cage during COVID-19 pandemic, Tunisia.



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Offshore aquaculture in COVID-19 crisis, Tunisia.

Artisanal Fisheries and Small-Scale Aquaculture in Chile from a Gender and Climate Change Perspective

Gender mainstreaming is being promoted through the project “*Strengthening the adaptive capacity to climate change in the fisheries and aquaculture sector of Chile*”. An analysis of results shows that the differentiated impacts of the effects of climate change on men and women require adaptation and mitigation strategies that recognize the different needs of both genders and that promote the mainstreaming of the gender approach in policies and measures to face climate change.

According to the National Fisheries and Aquaculture Service (SERNAPESCA), there are currently about 20 000 registered fisherwomen in the Artisanal Fisheries Registry in Chile; these women carry out various activities along the value chain, assuming key functions in the provision of inputs, extraction, cultivation, and primary and secondary processing, as well as in marketing. Women participate actively in the artisanal fisheries and small-scale aquaculture sector in Chile, being mainly involved in extraction and production activities, such as manufacturing fishing nets. Nonetheless, their key role in the value chain tends to be poorly recognized.



Mrs Angélica Martínez Martínez, partner S.T.I. Mariscadores y Buzos de Iquique – Albatroz, ex-union leader, owner and entrepreneur in the sale of seafood at the “TU Y YO” fishmonger in Caleta Riquelme.

The project “*Strengthening the adaptive capacity to climate change in the fisheries and aquaculture sector of Chile*”, executed by the Undersecretariat of Fisheries and Aquaculture (SUBPESCA) and the Ministry of the Environment, and implemented by FAO, with financing from the Global Environment Facility, started operations

in 2017 and is expected to end in June 2021. The project’s objective is to reduce vulnerability and increase the adaptive capacity to climate change in Chile’s small-scale fisheries and aquaculture sector. The pilots of this project are taking place in four coves located in different regions of the country. The selected coves are Caleta Riquelme in the Tarapaca region, Caleta Tongoy in the Coquimbo region, Caleta Coliumo in the Biobío region, and Caleta El Manzano-Hualaihue in the Los Lagos region.

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The project aims to generate actions and install capacities for climate change adaptation at the national, regional and local levels through three main components: (i) strengthening public and private institutional capacities; (ii) improving the adaptive capacity of artisanal fisheries and small-scale aquaculture; and (iii) promoting knowledge and awareness about climate change in communities.

In carrying out the initial analysis of the design and implementation of the project to strengthen the adaptive capacity to climate change in the Chilean fishing and aquaculture sector, the project team identified gender gaps that required special attention from the stakeholders



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Women in Caleta Tongoy in their first Japanese oyster seeding.

involved. The gender gaps included women's poor recognition, limited participation and decision-making in the local fisheries and aquaculture organizations, and their difficulties to access relevant information and capacity building activities related to their work. In fact, the representatives of the pilot coves who participated in the first workshop in Valparaíso and created the logical framework for the project reported little or no participation of women in some pilot coves, especially in Caleta Riquelme. Although some women are in leadership positions in the organizations of the pilot coves, usually their contributions are not recognized or are considered secondary.

The project design did not consider a gender mainstreaming strategy, however, the better understanding of women's role within the fisheries value chain demanded planning actions aimed to strengthen their economic and social empowerment, recognizing their needs, but also their relevant capabilities.

As part of the gender strategy, the project promoted the generation of collaborative workspaces open to the inclusion of views, opinions and experiences of both women and men, directly and together with other local actors from the community. These actions, carried out with the support of consultants and zonal technicians, made it possible to strengthen the role of women in the different activities at the local level. In this way, in the implementation of the project, working groups were formed to participate in activities related to adding value to fishery products post-capture and to encourage the creation of working networks and cooperatives in which the majority of the members were women.

A series of activities to strengthen adaptive capacity to climate change were carried out in the pilot coves. In Caleta Riquelme,

activities related to education and training on climate change and activities for adding value to fishery products had greater participation of women, while in Caleta Tongoy women took part in small-scale aquaculture for Japanese oyster farming, and today these women are forming a cooperative for the production and marketing of oyster products. In Caleta Coliumo, work has been led by a women's seaweed union; and in Caleta El Manzano-Hualaihué, work was carried out to add value to fishery products led by a group of women shellfish and seaweed collectors.

Women fishers, shellfish and seaweed collectors, partners or wives of fishers also participated in tourism activities in the four pilot coves of the project, including: ancestral traditions, seafood stalls, gastronomy, recreational fishing, and others. One example is the "Marine Tourist Route of Caleta El Manzano-Hualaihué".

In terms of women's empowerment, the project contributed to strengthening their cooperation and socio-economical capacities by improving their local organizations, such as the cooperative of women oyster producers of Caleta Tongoy.

The key results of the project, from a gender perspective, are the better understanding of women's role within the fisheries and aquaculture value chains, as well as the need to develop interventions that consider their particular needs, resources, capacities and knowledge. The adaptation practices developed by the project had the active participation of women in training and experiences in the field, in such a way that the women who participated in the workshops have been able to train other women



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Women fishers in Caleta Coliumo "culture" seaweed as a possibility of adaptation to climate change.

in their community to help replicate their experience and promote women's empowerment through activities related to fishing and aquaculture. By strengthening the integration of women in the different activities of the project, such as by promoting their incorporation into collaborative organizations, the number of women involved in the different productive chains in their coastal communities is expected to increase.

Incorporating a gender approach in the project has made it possible to implement effective solutions for increasing economic benefit and creating opportunities for aquaculture and fishing activities, both for women and men, and, overall, to reduce vulnerability to climate change in artisanal fisheries and small-scale aquaculture and increase its capacity of adaptation to climate change. As part of the project's sustainability plan, post-project activities will be further enhanced by the full implementation of the project's gender mainstreaming strategy, which will consolidate women's empowerment through various initiatives and promote their involvement in future productive, cultural and social development projects in coastal communities.

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Women shore collectors, in Caleta El Manzano, actively participated in training courses on adding value to fishery products, with local strategic allies such as the Municipality of Hualaihué and the Liceo de Hornopirén. The collectors later took technical tours to experience the work of other sea women in processing plants for added value to piure (tunicate *Pyura chilensis*) and also to strengthen cooperation networks among women. The collector's name is Marianela Maldonado.



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Small-scale fishers preparing for the day in Caleta El Manzano-Hualaihué, Chile.

Capacity-building: key to reducing vulnerability of artisanal fisheries and small-scale aquaculture to climate change in Chile



Successful closure of the b-Learning diploma course on Climate Change Adaptation in Fisheries and Aquaculture.
 Top corner, left: Luis Cubillos Santander, Centro COPAS Sur-Austral, Universidad de Concepción.
 Bottom corner, left: Ms Alicia Gallardo Lagno, Undersecretary of Fisheries and Aquaculture; right: Ms Eve Crowley, FAO Representative in Chile.

Chile's fisheries and aquaculture sector is well developed, but to date the effects of climate change scarcely have been considered. The low levels of professional training and experience in climate change issues, the limited availability of technology, a lack of established best practices, and management problems are all factors that make it difficult to incorporate measures to adapt to climate change. There is, therefore, strong

productive sector and on the livelihoods of fishers; in addition, the sector also lacks appropriate assessments to determine local vulnerability with a focus on artisanal fishing and small-scale aquaculture.

This article presents some of the main components needed to reduce the vulnerability of artisanal fisheries and small-scale aquaculture to climate change in terms of awareness and capacity-building. Both of these components are addressed in the project "Strengthening the adaptive capacity to climate change in the fisheries and aquaculture sector of Chile", which has been executed by the Undersecretariat of Fisheries and Aquaculture (SUBPESCA) and the Ministry of the Environment (MMA), and implemented by the Food and Agriculture Organization of the United Nations (FAO), with funding from the Global Environment Facility (GEF). The pilot project, which started in April 2017 and ends in June 2021, is concentrated in four coves: Caleta Riquelme, in the Tarapacá region; Caleta Tongoy, in the Coquimbo region; Caleta Coliumo, in the Biobío region; and Caleta El Manzano-Hualaihué, in the Los Lagos region, which altogether represent part of the diversity of the communities dedicated to fishing and/or aquaculture.

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To make visible the challenge of climate change and the need for adaptation of fishing and aquaculture communities, the project deployed the following training initiatives, encompassing multiple actors.

Design and implementation of a training programme on climate change adaptation in fisheries and aquaculture for public officials, national experts and decision-makers at the national, regional and community levels

Aware of the importance of actively involving decision-makers, this programme contemplated two training areas and target groups: (i) experts and regional and community authorities; and (ii) officials linked to public institutions who manage fisheries and aquaculture at the central, regional and communal levels. For both groups, the programme addressed aspects of the climate system, listed impacts, vulnerability and adaptation capacity of fisheries and aquaculture in the face of climate change, and noted governance systems to address this phenomenon.

In order to prepare public institutions at the national level to promote greater adaptation of artisanal fisheries and small-scale aquaculture to climate change, within the framework of the project, the University of Concepción supported: (i) the execution of seven workshops with experts from the regions of the north, center and south, registering more than 120 attendees; (ii) carrying out eight face-to-face awareness/training workshops throughout the country, registering the attendance of 122 community authorities and regional governments or their representatives; and (iii) intensively training 159 public officials at the national, regional and communal levels from Arica in the north to Punta Arenas in the south. The trained officials received their diploma from the b-Learning course “Climate change adaptation in fisheries and aquaculture” on 13 August 2020.

Training programme on climate change adaptation for artisanal fishers and small-scale aquaculture communities

Considering the need for artisanal fishers and small-scale aquaculturists to have necessary skills for confronting the challenges of climate change, this programme was carried out in the four pilot coves. Its design addressed the development of three types of training skills in ten sessions: (i) understanding climate change and its effects at the global and local level; (ii) correctly identifying the risks associated with climate change applied to fishers’ and aquaculturists’ local realities; and (iii) proposing adaptation actions to the possible effects of climate change at the local level. The contents and the strategies applied were synthesized in a Practical Manual for artisanal fishers and small-scale aquaculturists and a Guide for Trainers, which seek to support their use and promote their replicability.



Group work for the formulation of a climate change adaptation project within the framework of training sessions. Caleta Coliumo, Biobío region. The participation of women was a prominent element in Coliumo and also at the national level, giving an account of the contribution and true role of women in coastal communities.

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One hundred forty-seven fishers, aquaculturists, and mussel or clam collectors of the pilot coves participated in the programme, with special emphasis on the participation of women, who exceeded 50 percent of the attendees. Of the total, 63 people achieved the minimum number of sessions required (five), with women representing 68 percent of this number. In addition, at least five trainers were identified among the participants with the purpose of assuming a leading role in their respective coves to give continuity to the process.

Basic, local environmental monitoring programme to improve the adaptation of the fisheries and aquaculture sector to climate change

In each pilot cove, a local monitoring programme of environmental variables related to climate change (for example temperature, salinity, and dissolved oxygen) was designed and implemented, with active participation of women and men. Scientific/technological information was communicated and expanded upon to increase participant knowledge of the coastal environment and allow attendees to sustain their own monitoring programmes in the future. The focus of this initiative was to complement the historical knowledge of the coastal zone that these communities already possess with tools that allow community members to record and systematize their own observations, thus facilitating decision-making related to their productive activities. This pilot training experience was synthesized in the “Manual for a participatory environmental monitoring system that improves the capacity of adaptation to climate change of fisheries and aquaculture communities in Chile” and in three short videos that will support future implementations of this type of monitoring in other coves.

“Cove”, an educational, collaborative and family board game

With the aim of reinforcing the knowledge of the communities regarding climate change, its effects and the different adaptation strategies that can be deployed in response, the board game called “Cove – Together we can adapt to climate change” was created; the game

seeks to promote an instance of collective learning within families. As a pedagogical tool, this game aims to obtain the greatest diversity of resources and possible goods on the part of the competitors, to enable the diversification of productive activities (boats, materials for fishing and aquaculture, among others) to help reduce vulnerability to climate change. This board game seeks to give a positive approach to climate change, focusing on the opportunities it offers and motivating people to better prepare for its consequences.

The different experiences deployed in the area of awareness and training on climate change shed light on a multiplicity of gaps that need to be addressed in order to reduce the vulnerability of artisanal fisheries and small-scale aquaculture to climate change in Chile.

The limited information available at the local level on climate change constitutes one of the main challenges. Through their experience and knowledge, experts and public officials identified gaps associated with low relevance, the difficulties of accessing information and opportunities for generating information, and the need for incorporating climate change activities and/or measures in study programmes at all levels. Other negative factors include limited human and technological capacities to face the adaptation process and the presence of weakened and uncoordinated public institutions.

In terms of opportunities, the training of public officials made it possible to identify an important potential for promoting multidisciplinary and collaborative work. The participation of officials with different professional backgrounds and from various institutional cultures significantly enriched the elaboration of vulnerability case studies developed within the framework of the semi face-to-face training programme (b-Learning), which culminated in these officials achieving a diploma that accredits their skills.



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Monitoring of environmental variables with mussel, clam and razor clam collectors in Caleta El Manzano. At the end of the training, Ms Maida Gueicha mentioned that "she learned how environmental monitoring equipment works" and highlighted the importance of monitoring to understand the environment, where the resources are and how they could be affected by climate change.



Board and box of the board game "Cove".

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Regarding the possibility of replicating and sustaining the work developed with the fishing and aquaculture communities in terms of adaptation, the need to strengthen the current institutional framework and governance associated with climate change (Regional Climate Change Committees) was identified as a key aspect, and to explicitly incorporate this variable in the Chilean Fisheries Management Committees.

The success of these training initiatives depends not only on the interest and commitment of the local community but also on the availability of resources for the training of facilitators or trainers, who play a key role in leadership and promotion for the proposed learning processes. The availability of resources raises, in turn, the need for local governance associated with these programmes, including public and private institutions, scientists and local organizations.

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Conservation of Farmed Aquatic Species: an Opportunity We Must Not Miss!

Conservation of biodiversity is critical, as no amount of technological or scientific progress can eliminate humankind's dependence on nature for our collective livelihood and well-being. However, in recent decades, it has become undeniable that we are living in times of severe global biodiversity crises and that anthropogenic activities are the main cause of habitat deterioration and biodiversity decline. This article examines the status of aquatic biodiversity with a focus on species used for food and agriculture.

In the preparation of the report on *The State of the World's Aquatic Genetic Resources for Food and Agriculture* (SoW-AqGR),¹ we noted that, based on the country reports from 92 countries, the wild relatives of all farmed species still exist in the wild (extant). Taken at face value this is a positive finding, suggesting that diversity of aquatic species may not yet be seriously threatened and that the status of aquatic diversity may be more secure than for species used in terrestrial agriculture.

The website of the Red List of the International Union for Conservation of Nature (IUCN)² enables users to conduct advanced searches and to filter species using a range of search options. In this context, however, it is not possible to search only species used in aquaculture and fisheries (or indeed for food production systems in general), so we filtered those aquatic species that are listed as being

harvested for human food, which totalled 7 621 assessed species. This number of species is much greater than the number of species known to be harvested from capture fisheries (~1 800) and/or used in aquaculture (~700) because it essentially includes all aquatic species that are harvested as food but do not necessarily form recognized fisheries. The analysis identified that 1 553 (20 percent) of these 7 621 species are assigned to one of the "extinct or at risk" categories, specifically: 27 species are classified as Extinct, 2 as Extinct in the Wild, 289 as Critically Endangered, 395 as Endangered, 501 as Vulnerable, and 339 as Near Threatened. It was, however, not feasible to determine if these proportions could be extrapolated and considered to be representative of the species recorded by FAO as fished and/or farmed. Given this limitation and the fact that the conservation status of farmed aquatic species and their wild relatives, also referred to as aquatic genetic resources (AqGR), is even less well understood than for fishery stocks, we decided to conduct a more in-depth analysis to identify the status of risk of only aquaculture species within the IUCN Red List, and also to examine which of these species are addressed by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).³

The subset of aquaculture species targeted in our analysis were the species for which FAO Members reported regular production statistics in 2018 and those species reported for the first time in the country reports submitted for the preparation of the SoW-AqGR. The analysis of a total of 441 species (see Table 1) showed that 10 percent of those that had been evaluated are listed as under threat (Critically Endangered, Endangered or Vulnerable). A further 16 species (3.5 percent) are classified as Near Threatened.

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1. www.fao.org/3/CA5256EN/CA5256EN.pdf

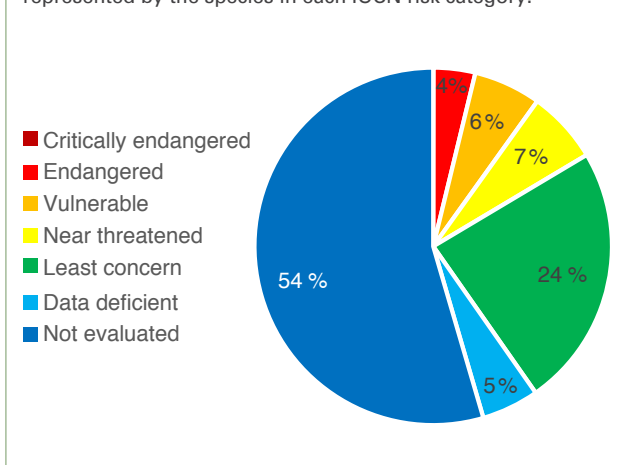
2. <https://www.iucnredlist.org>

3. <https://cites.org/eng>

TABLE 1 – Number of farmed aquatic species, by IUCN categories.

IUCN category	Number of species
Critically Endangered	8 (2%)
Endangered	13 (3%)
Vulnerable	25 (5.5%)
Near Threatened	16 (3.5%)
Least Concern	160 (36%)
Data Deficient	17 (4%)
Not Evaluated	202 (46%)
Total	441

Table 1 simply shows the proportion of all farmed species, but not how important they are to aquaculture production. Figure 1 shows, for each IUCN category, the proportional contribution to 2018 global aquaculture production of the species allocated to these categories. The species identified as threatened represented 10 percent of production, with the 2 percent classified as Critically Endangered, 3 percent as Endangered and 5.5 percent as Vulnerable. These “at risk” species are thus significant contributors to global aquaculture. It should be noted that almost half (46 percent) of aquaculture species are classified as Not Evaluated and 4 percent as Data Deficient. The remaining categories, Near Threatened and Least Concern, represent 3.5 and 36 percent, respectively. The fact that a species has not yet been assessed or is classified as Data Deficient does not imply that it is not under some level of risk.⁴

FIGURE 1 – Proportion of global aquaculture production represented by the species in each IUCN risk category.

Among the major species produced in global aquaculture, some are Near Threatened, such as the silver carp (*Hypophthalmichthys molitrix*), while others are listed in threatened categories, including the striped catfish (*Pangasianodon hypophthalmus*) and the Japanese sea cucumber (*Apostichopus japonicus*), both Endangered, and the common carp (*Cyprinus carpio*) and the Chinese softshell turtle (*Pelodiscus sinensis*), both Vulnerable. However, many important aquaculture species have not

yet been evaluated, and these include: other major carps; salmonids; crustaceans such as whiteleg shrimp (*Penaeus vannamei*), giant tiger prawn (*Penaeus monodon*) and Chinese mitten crab (*Eriocheir sinensis*); molluscs such as Pacific oyster (*Crassostrea gigas*) and Japanese carpet shells (*Ruditapes philippinarum*); and all the major farmed seaweeds.

Considering that fish and fishery products are among the most globally traded food commodities, it was worthwhile to assess which aquaculture species, if any, are subject to some level of regulation under the CITES and are therefore classified under one of the three CITES Appendices. These Appendices correspond to different degrees of regulation: Appendix I includes species classified as threatened and for which trade is allowed only in exceptional cases; Appendix II includes species not necessarily threatened but for which trade is subject to restrictions to avoid incompatibility with their survival; and Appendix III includes species that are protected in at least one country and for which the country has asked assistance from other CITES Parties in controlling trade.⁵

Surprisingly, we found that only one of the analyzed species, namely Isok barb (*Probarbus jullieni*), is included in Appendix I of the Convention and that 16 species are reported in Appendix II. The remainder, 96 percent of the species, are not listed in any of the CITES Appendices. Among the few species covered by CITES, examples of the main commercially important ones, on a global scale, are the European eel (*Anguilla anguilla*) and several sturgeon species.

The fact that half of the farmed aquatic species on which we depend have not been evaluated for assignment to IUCN categories, or are classified as Data Deficient, reinforces that we need further efforts, at the international level, to gain awareness of the possible risk of extinction of these species. It would also be helpful if the IUCN could enable filtering species by food production systems and not only by broader use categories such as “Food – human”.

Based on our analysis, it is evident that the extant status of all currently cultured species, while it is a status we must attempt to retain, is not representative of an absolute picture of the status of AqGR globally and does not mean that some species are not under significant levels of threat. These lists (IUCN and CITES) are based on the status of the wild relatives of cultured species. To aquaculturists, it is surprising to see major aquaculture species such as common carp and silver carp listed as Vulnerable or Near Threatened, respectively, highlighting that even if a species is widely farmed and in massive numbers its wild populations can still be at risk. Clearly, and as noted in the SoW-AqGR, aquaculture can act as a vehicle for conservation of aquatic diversity, and it is thus important

4. IUCN. 2012. *IUCN Red List Categories and Criteria: Version 3.1*. Second edition. Gland, Switzerland and Cambridge, UK: IUCN. iv + 32 pp. <https://portals.iucn.org/library/node/7977>

5. <https://cites.org/sites/default/files/eng/disc/CITES-Convention-EN.pdf>

6. <http://www.fao.org/3/ca8302en/CA8302EN.pdf#page=40>

that genetic diversity is managed effectively within aquaculture. While aquaculture might not conserve the specific genetic identity of a certain wild stock in the way that a gene bank could (due, for example, to genetic drift or deliberate selection), it is likely that the genes from the source population are retained within the farmed resource overall and thus are not completely lost to aquaculture if the original wild source population is compromised or goes extinct. In this sense, aquaculture can help in conserving part of the gene pool of the original wild populations; however, it cannot be the solution, only part of it.

It is crucial, when considering the conservation status of a species, to analyze the genetic diversity not only of wild stocks but also of farmed AqGR, such as strains, varieties and hybrids, collectively included under the broader definition of farmed types.⁶ In this regard, it is interesting to make a comparison between aquaculture and the livestock and crop sectors. Comparing knowledge on cultured aquatic genetic resources to that of these other two food production sectors, it is evident that many countries still have a limited and quite scattered documentation on the characteristics of their aquaculture farmed types, including a paucity of information on their intraspecific genetic diversity. It is essential to note that genetic diversity is the basis on which farmers can maintain and improve broodstock and develop new farmed types in response to different drivers (for example market demand, climate change, resistance to diseases, nutritional requirements).⁷

To address the general absence of information on farmed AqGR, especially below the level of the species, FAO is developing a resource for its Members, in the form of a Registry of farmed types within which countries and stakeholders can report a range of information on the status of management of their cultured genetic resources, including information on distinctive characteristics of each farmed type (for example production performance, phenotypic characteristics and molecular-diagnostic characteristics), their estimated contribution to national production and the main reasons for their production. This information will be made publicly available and will contribute to fill this knowledge gap that is critical to inform decision-making on possible conservation initiatives.

The type of information collected in the Registry for aquatic resources is already broadly available to the livestock and crop sectors, both of which have established, for many years, dedicated information systems with associated indicators to monitor the risk of extinction of farmed species and of their breeds (livestock sector) and varieties (crop sector). For example, thanks to the data collected in these information systems, we know that, globally, 59 percent of livestock breeds are classified as being of unknown risk status, 10 percent as not at risk, 24 percent as at risk, and 7 percent as extinct.⁸ We have

no such knowledge base to make similar assessments for aquatic farmed types: the Registry is expected to fulfil this role and, hopefully, to go beyond. Indeed, FAO is planning to further expand the Registry into a global information system that will include information on wild stocks and indicators to assess the conservation of farmed species, and also of their farmed types and wild relatives.

Because of the absence of relevant information, the management of AqGR has in part fallen behind the management of genetic resources in other sectors in terms of development of Sustainable Development Goal (SDG) indicators for measuring directly the vulnerability of AqGR, both farmed and wild. FAO is the “custodian” agency for 21 indicators under SDGs 2, 5, 6, 12, 14 and 15, and also a contributing agency for other SDGs. Nevertheless, even if several of these indicators measure, directly or indirectly, biodiversity for food and agriculture, none of them specifically mention AqGR farmed types or their wild relatives living in freshwater habitats. The only indicator covering AqGR for food and agriculture is indicator 14.4.1 (“*Proportion of fish stocks within biologically sustainable levels*”), under SDG 14. However, freshwater fisheries are not directly mentioned under the targets and indicators of SDG 14 and, in general, in any of the 169 indicators of the SDGs, making them under-reported, as observed in a recent landmark report from the WWF.⁹ This report further notes that inland and farmed AqGR are often undervalued and forgotten by decision-makers although a third of all freshwater finfish species (which is to say, not only those used for food and agriculture) are threatened and 80 species have already gone extinct.

Conserving genetic resources for food and agriculture, both in the wild and on the farm, means also to maintain the evolutionary potential of a species and its capacity to respond and adapt to a constantly changing environment where factors such as climate change and diseases can alter ecosystem equilibria and threaten species and populations. Aquaculture is a much more recent food production system compared to the livestock and crop sectors, and we must learn from the experience of these two sectors. Given the relatively recent domestication of most cultured aquatic species, many farmed types generally retain high levels of genetic diversity, and it is necessary to improve genetic management of these resources to ensure this diversity is conserved. In this article, we note that all cultured aquatic species still exist in the wild but that a significant proportion of these species are under threat. Clearly, we have a limited window of opportunity to put in place measures to conserve these resources for the future and to generate and make available more and better information to set and implement successful conservation initiatives.

7. <https://doi.org/10.1111/j.1439-0531.2012.02084.x>

8. www.fao.org/3/ca3129en/CA3129EN.pdf

9. https://wwf-lac.awsassets.panda.org/downloads/worlds_forgotten_fishes___wwf_2021.pdf

Aquaculture Parks: From Planning to Industrial Cluster

A business cluster, first popularized by Michael Porter in the 1990s, is a geographic concentration of interconnected businesses, suppliers and associated institutions in a particular field, wherein enough resources and competencies have amassed to reach a critical threshold. A business cluster holds a key position in a given economic area and has a decisive sustainable competitive advantage over other locations. Aquaculture parks, also named aquaparks, are a type of this modern business cluster specifically focused on aquaculture, and this concept has been introduced and practiced in many countries. Aquaparks aim to improve the sustainable development of the aquaculture sector in several ways. Perhaps most importantly they support governance and decision-making in a specific geographical area, especially in identifying Allocated Aquaculture Zones (AZA), supporting site selection, licensing and permitting, and facilitating environmental monitoring processes and reporting. Aquaculture relies not only on natural resources but also on skilled human resources and various services, for example seed and feed supply, veterinary services, machinery, processing and marketing. Arranging these supporting services in an organized area can reduce costs, build synergies and incubate further development. Geographical identification of aquaculture products, including branding, quality monitoring and marketing, is also facilitated through an aquaculture cluster approach. Aquaparks improve coordination, collaboration and organization among aquaculture value chain actors by clustering production and supporting services in a geographically designated area, with the aim of supporting overall aquaculture development.

Brief evolution of aquaculture parks:

- i) In the 2000s, Brazil adopted an aquapark planning strategy and identified locations for aquaparks in several reservoir areas, specifying site, area, farm distance, species, stocking and feeding rate. The aquaparks mainly focused on spatial planning supporting site selection and space allocation for aquaculture, which was based on natural biomass carrying capacity and facilitated by improved protection from intervention by other sectors.
- ii) In 2001, the concept of a “mariculture park” was first initiated by the Philippine Bureau of Fisheries and Aquatic Resources in the coastal waters of Samal Island in Davao del Norte with three floating cages stocked with milkfish for demonstration. In 2009–2011, marine aquaparks in the Philippines were developed through project-supported activities; the plan is still applicable for guiding the allocation of marine cages, although it is not fully implemented due to lack of adequate investment.
- iii) In Uganda, under the national aquaculture policy, the Government sought to identify and map out areas for concentrated aquaculture production, akin to industrial or business parks, dedicated for the purpose of commercial aquaculture development, both for land and water-based aquaculture. Starting in 2016, the European Union has supported the establishment of two aquapark projects, one for cages and one for pond fish farming. The projects aim to improve the infrastructure to support aquaculture development, such as road access, electrification, irrigation and technical components, such as a hatchery, feed mills, veterinary services and marketing facilities.
- iv) In Zambia, the revised Zambia National Aquaculture Development Plan (2015–2020) aims at improving aquaculture’s contribution to national food and nutrition security, poverty reduction, national economic growth and the balance of trade. The Government has established four pilot aquaculture parks which are intended to create employment opportunities through commercial and value addition in the aquaculture subsector in the country.
- v) In China, the aquapark concept was developed based on the demand of small-scale farmers, and focused on food production, improved income and poverty reduction. The Government guided the planning and provided technical and financial support for infrastructure improvements, such as roads, electricity, irrigation systems and technical training. Through public-private partnership mechanisms, investment was directed to local hatcheries, feed mills and processing factories, which require high levels of skilled labour, technical professionals and large investments. As a result, farmers could enjoy the advantage of infrastructure and technical services, as well as improved business models and risk management. There are several models of aquaparks in China, differing according to the local environment, type of aquaculture, available resources and stakeholder demand. Some examples include aquaparks of terraced rice-fish farming, aquaparks with coastal communities for yellow-croaker cage culture, and aquaparks with solar panels and crab farming. These aquaparks can have extended

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functions with tourism and restaurants and with dynamic components of processing, e-commerce and others.

Many countries provide success stories on aquapark establishment and operation, particularly in supporting small-scale farmers in aquaculture development, technical support, branding and marketing, and multifunction farms. In order to improve knowledge and share good practices on aquaparks, FAO, with the support of the Yanbao Fund (China) through the South-South and Triangular Cooperation, will organize an expert workshop on aquaparks. The objectives will be to review the global state of knowledge and best practices of aquaparks establishment and operation, to provide capacity building and training for government officers from Africa and Latin America, and to learn from the Chinese experience in aquapark planning, establishment, operation, management and public-private partnership. This programme will include a two-week study tour, with lectures by experts, officers, and exchanges with farmers and aquapark stakeholders, as well as field visits to several aquaparks in China.

The pilot programme will be held 18–29 October 2021 with 20 participants, and will highlight the exchange and discussion on successful operations of aquaparks:

- i) planning and policy support, including site selection, spatial planning and monitoring;
- ii) government and public-private partnership investment in infrastructure;

- iii) organization and cooperation among farmers and supporting services in aquaparks;
- iv) geographical identification of aquaculture products, including branding, quality monitoring and marketing; and
- v) diversified models and functions of aquaparks.

As we continue to explore aquaculture parks, we invite all interested stakeholders to contribute best practices in planning, establishment and operation, as well as any input and comments on relevant knowledge products. Besides welcoming cooperation, we are prepared to provide necessary technical support on knowledge sharing and capacity-building opportunities. Kindly contact the authors should you wish to engage.

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Aerial view of an aquaculture park in China.

Past, Present and Future Scenarios for SDG-aligned Brine Shrimp *Artemia* Aquaculture

The 0.5 mm *Artemia* nauplii that can be easily hatched out from so-called “dried cysts” (in other words inactive embryos in late gastrula stage) are used as a suitable substitute for natural live plankton in the feeding of a wide variety of marine and freshwater crustaceans and fishes. In the 1960s, two companies in the United States of America started marketing *Artemia* cysts collected from the salt ponds in San Francisco Bay, California, and the Great Salt Lake, Utah. Initial use of these cysts was by aquarium hobbyists to prepare live food for their ornamental pets.

As of the 1960s, different research institutes developed the first hatchery protocols with *Artemia* nauplii as a crucial live food source, initially in Japan with Japanese seabream and kuruma shrimp and soon thereafter in other parts of the world with other fish, shrimp and prawn species. The two companies mentioned above started receiving increasing demands for their products, and market prices quickly increased to more than USD 70 per kg despite inconsistencies in hatching qualities. The possible dramatic impact of a cyst shortage on the expansion of aquaculture was repeatedly underlined at international conferences in 1969 and 1972, culminating at the 1976 FAO Technical Conference on Aquaculture in Kyoto, where the conference chairman, the late Dr Ramu Pillay, stated that it was not advisable to develop an aquaculture to feed the poor if one had to rely on hard currency to purchase *Artemia* cysts.

However, an alternative idea was postulated that the critical *Artemia* shortage was solvable and that there were several challenges to be addressed, for example exploitation of more natural resources; transplantation and inoculation of suitable habitats; improved techniques for cyst harvesting, processing, storage and hatching; as well as the use of juvenile/adult *Artemia* biomass. Within the following two years and with the support of FAO and the Southeast Asian Fisheries Development Center (SEAFDEC), the possibility to produce *Artemia* in seasonal salt ponds in the Philippines and to apply new techniques for *Artemia* use in the hatchery were demonstrated. In 1977, a small quantity of *Artemia franciscana* nauplii from San Francisco Bay was introduced in the large salt pond complex in Macau (Rio Grande do Norte, Brazil), and less than six months later the first tonne of top-quality cysts was harvested.

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Clockwise from top:
Trainee from Kenya at the *Artemia* field station of Can Tho University in Vinh Chau, Viet Nam.
Harvests of first *Artemia* produced in Myanmar salt farm.
Freshly hatched instar I *Artemia* nauplii.

Confidence increased regarding a future for *Artemia* in hatchery aquaculture and, upon recommendation of FAO, the *Artemia* Reference Center was founded in 1978 at Ghent University in Belgium.

An international interdisciplinary approach was adopted by *Artemia* experts from Europe and the Americas to address various issues in characterizing species and strains, develop techniques for processing cysts, large-scale hatching and use of *Artemia* under different new product forms, such as decapsulated cysts, cold-stored nauplii and enriched metanauplii. More than 65 scientific articles were published under the common heading “International Study on *Artemia*”, international conferences were organized, and further extension was ensured through the publication of the FAO Manual and the organization of many local training courses. This also resulted in the identification and exploitation of new natural resources in Australia, Brazil, China, Ecuador, Iran (Islamic Republic of), the Russian Federation and Venezuela (Bolivarian Republic of); and the setting up of seasonal *Artemia* production in coastal artisanal salt works in Kenya, Mozambique, Peru, the Philippines, Sri Lanka, Thailand and Viet Nam. As of the 1980s, and especially in the 1990s, the commercial hatchery industry experienced a boom, particularly with marine shrimp aquaculture growth in Latin America and Asia, and with marine fish in Asia and Europe. Annual *Artemia* cyst consumption increased from less than 100 tonnes in the 1980s to over 2 000 tonnes by the turn of the century.

New resources, mainly in Central Asia (large salt lakes and lagoons in China, Kazakhstan, Siberia (Russian Federation), Turkmenistan and Uzbekistan) were tapped and several



Lake harvesting of *Artemia* cysts at the Great Salt Lake (Utah, United States of America).

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new companies entered into business. Meanwhile, seasonal *Artemia* production integrated in artisanal salt ponds was further developed and adopted in many countries, with Viet Nam as the most successful producer of 40 tonnes of superior quality cysts in a dry season of only four months. Such integration of salt production with *Artemia* (in the dry season) and other aquaculture species (in the rainy season) maximizes land use and has beneficial socio-economic impacts, in addition to acting as a catalyst for new aquaculture developments in remote regions. Better knowledge of nutritional requirements of fish and shrimp larvae allowed for gradually reducing the amount of *Artemia* cysts needed in the hatchery productions. For example, where 25 kg of cysts were initially needed for the production of 1 million shrimp postlarvae, this amount now has dropped to about 3 kg. With the expansion of hatchery production of more aquaculture species, the demand for *Artemia* cysts has continued to increase and annual consumption is now estimated at 3 500–4 000 tonnes for the production of over 900 billion crustacean postlarvae and fish fry by a hatchery industry valued at more than USD 2 billion and responsible for the final production of over 10 million tonnes of high-value aquaculture species (for example shrimp, prawn, crab, bass, bream, grouper, flounder, milkfish and catfish).

Currently, commercially available cysts are harvested from the Great Salt Lake in North America, from several large salt lakes and coastal salt works in Asia, and from controlled production (but still in moderate quantities) in seasonal salt works in southeast Asia.

As has happened with several lakes in the past decade, inland salt lakes are under constant threat of drying up, and with climate change this situation could only worsen in the future. With approximately 90 percent of the current *Artemia* production harvested from inland salt lakes, the future of the hatchery industry could be at risk and requires urgent attention.

A new international interdisciplinary approach is needed to tackle these *Artemia* issues and opportunities, similar to the breakthrough in *Artemia* use in aquaculture following the FAO Kyoto conference. To guarantee a more sustainable provision of *Artemia*, several critical issues need to be addressed and opportunities explored, including:

- conservation of *Artemia* biodiversity;
- use of science-based protocols/guidelines for sustainable harvesting of wild sources;
- socio-economic opportunities for integration of *Artemia* production as extra income in the many seasonal artisanal salt farms in Asia and Africa;
- study of the impact of climate change on *Artemia* production;
- development of new applications through strain selection and selective breeding;
- propagation of improved guidelines, updated FAO *Artemia* manual, and increased training and extension services;
- integration of extractive *Artemia* farming with intensive fish/crustacean aquaculture; and
- use of *Artemia* biomass as a high-value protein ingredient in local human diets.

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Gender on the Agenda: Towards the Achievement of SDG 5 in Aquaculture

Gender equality and ending all discrimination against women and girls are not only basic and fundamental human rights, but they are also a necessary foundation for a peaceful and sustainable world. Yet, discrimination against women and girls in aquaculture and fisheries is a tangible and persistent reality despite the fact that it has been proven that empowering women and girls helps in economic growth and development.¹

Why gender equality matters for achieving the 17 SDGs

More than five years ago the United Nations Member States adopted the 2030 Agenda for Sustainable Development (2030 Agenda) and the associated Sustainable Development Goals (SDGs). The 2030 Agenda aims at unifying stakeholders around a common goal: building a just, rights-based, equitable and inclusive world.² The promotion of sustained and inclusive economic growth, social development and environmental protection for the benefit of all – including women, children, youth and future generations – are at the core of the 2030 Agenda.³

The SDGs are integrated and indivisible, meaning that no one goal is separate from the others and that all the goals require comprehensive and participatory approaches. This intersection between the SDGs is fundamental to consider, especially when it comes to gender equality and the empowerment of all women and girls – embodied by SDG 5, which is an explicit stand-alone goal and a cross-cutting issue, as well as a driver of sustainable development in all its dimensions. It is the reason why it is repeatedly stated that without a systematic incorporation of the *gender lens* in the implementation and monitoring of the SDGs, progress will inevitably falter and the 2030 Agenda as a whole will not be realized.⁴

Aquaculture contributes to 15 out of the 17 SDGs, with many specific targets directly relevant for the sector, such



A small gathering of women on the banks of an aquaculture pond in Kipushi, Democratic Republic of Congo.

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as the need for pro-poor and gender-sensitive development strategies (target 1.b), the access to equal rights to economic resources (target 1.4), full and productive employment and decent work for all women and men (target 8.5), and the protection of labour rights and the promotion of safe and secure working environments for all workers (target 8.8).⁵ Recognizing that the SDGs are interdependent, it is crucial to intersect SDG 5 and the aquaculture sector in order to maximize its contribution to the SDGs but also to capture the reality of women, men, boys and girls in the sector.

Intersecting SDG 5 and the fisheries and aquaculture sector

SDG5's first target (5.1) – “End all forms of discrimination against all women and girls everywhere” – could not be more universal. “Everywhere” includes the fisheries and aquaculture sector, where women constitute half of the workforce throughout the value chain. Invisible, Ignored and Unrecognized (IUU), women face discrimination and gender-based constraints in a sector characterized by a gendered division of labour. Deeply rooted perceptions regarding the behaviour and roles that women and girls “should” perform make these issues extremely complex. This is why gender studies in fisheries and aquaculture highlight the need for transformative change, carried out through Gender Transformative Approaches to address the root causes of gender inequalities.

Violence against women and girls, embodied by target 5.2 – *Eliminate all forms of violence against all women and girls in the public and private spheres, including trafficking and sexual and other types of exploitation* – has

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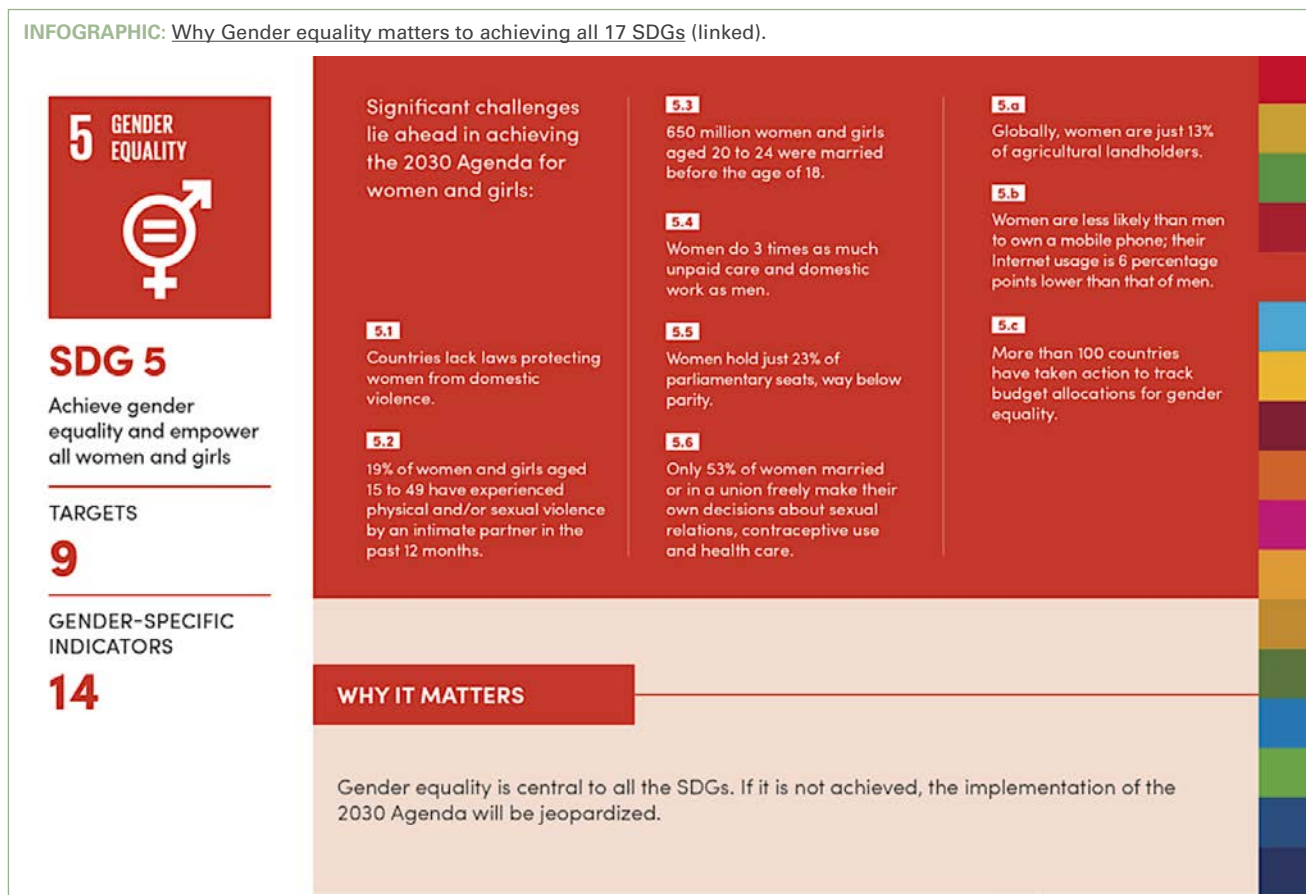
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been exacerbated by the COVID-19 pandemic and made visible on the international scene. It is all the more urgent to support women and children (in aquaculture, fishing and processing communities) who face domestic violence, gender-based violence and intimate partner violence (FAO, 2021).⁶ Similarly, it is urgent to address sexual exploitation and abuse that occur, for example, through transactional sex practices known as “fish for sex” or “sex for fish”. COVID-19 has also exacerbated women’s and girls’ caregiving burden, as they are traditionally responsible for unpaid care and domestic work, which includes not only cooking and food preparation, cleaning, washing clothes, water and fuel collection, and direct care of children, the elderly, persons with disabilities and able-bodied adults but also voluntary community work (UN Women, 2016).⁷ This is reflected in **target 5.4** – *Recognize and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies and the promotion of shared responsibility within the household and the family as nationally appropriate.*

While women’s lack of access to resources, services, credit, finance, infrastructure, education, information, and

training (**target 5.a**)⁸ is often recognized in development interventions and research, universal access to sexual and reproductive health care (**target 5.6**)⁹ in aquaculture and fishing communities is barely addressed. It is also the case of the issues outlined in **target 5.2** – *Eliminate all harmful practices, such as child, early and forced marriage and female genital mutilation*, as these practices are not understood nor addressed in the fish supply chain.¹⁰ Moreover, **target 5.b** – *Enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of women* – echoes the gender digital divide, which highlights gender stereotypes and biases that impact women’s and girls’ access to technology and the Internet. This is particularly relevant to processing and trade where women are strongly represented. The lack of access to gender-responsive technology often results in food loss and waste and high occupational safety and health risks, resulting in significant deleterious health implications.

Whereas the indicators for **target 5.5** – *Ensure women’s full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life* – are predominantly related to national parliaments, local governments and managerial positions, women’s participation in decision-making processes and leadership at all levels is fundamental

6. FAO. 2021. *The impact of COVID-19 on fisheries and aquaculture food systems, possible responses*. Information paper. November 2020. Rome. <https://doi.org/10.4060/cb2537en>

7. www2.unwomen.org/-/media/field%20office%20eseasia/docs/publications/2017/01/unpaid-care-and-domestic-work-en.pdf?la=en&vs=435

8. **Target 5.a:** Undertake reforms to give women equal rights to economic resources, as well as access to ownership and control over land and other forms of property, financial services, inheritance and natural resources, in accordance with national laws.

9. **Target 5.6:** Ensure universal access to sexual and reproductive health and reproductive rights as agreed in accordance with the [Programme of Action of the International Conference on Population and Development](#) and the [Beijing Platform for Action](#) and the outcome documents of their review conferences.

10. <https://igssf.icsf.net/en/yemaya/detail/EN/2270.html?detpag=mapart>

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Workers processing fish fillets in Kitale, Kenya.

in achieving equitable and sustainable aquaculture in fisheries. Women are disproportionately represented in leadership positions along the value chain, perpetuating the perception that women are not capable of participating and making decisions on the same level as men are.

What is FAO doing?

The newly restructured Fisheries Division reiterated its commitment to gender equality by strengthening gender mainstreaming in its normative work, following the renewed FAO Policy on Gender Equality Policy 2020–2023.¹¹ Gender equality is central to FAO's mandate, and it is central to achieving the SDGs. For this reason, the Fisheries Division has engaged in new activities addressing gender and women's empowerment as part of the implementation of the 2021 Declaration for Sustainable Fisheries and Aquaculture.¹²

On 8 March 2021, the Fisheries Division Gender Team hosted a webinar on the occasion of International Women's Day entitled "Women's Leadership in Fisheries and Aquaculture".¹³ The webinar was opened by FAO's Deputy Director-General Maria Helena Semedo, who emphasized that working together towards removing gender-based constraints is crucial, as they prevent women to empower themselves, to realize themselves and to reach their full potential. She also highlighted the fundamental need for male allies in the fight for gender equality and called for increasing our efforts to make women's and girls' contribution to fisheries and aquaculture more visible. A panel¹⁴ made up of women leaders in the seafood sector included Shirlene Anthony Samy of INFOFISH; Christelle Vigot and Marie-Christine Monfort of the International Organisation for Women in the Seafood Industry; and Yuki Chidui, sushi chef and owner of Nadeshico Sushi, Tokyo. As women in a sector dominated by men, the panellists shared their experiences, highlighting their successes but also the challenges and constraints they faced as they

rose to positions in leadership. Shirlene Anthony Samy raised the potential of e-commercial platforms to allow more women to sell and trade fisheries and aquaculture products, as the digital platforms freed women from some of the gender-based constraints that limit in-person commerce. Yuki Chidui and Shirlene Anthony Samy raised the need for daily action and steps forward, even if the steps are small, to change and challenge restrictive norms, while Christelle Vigot reminded participants to reflect on the type of leadership we want today. Marie-Christine Monfort made a clear call that we must always "count, count, count" to make the invisible visible and to work towards gender equality as a fundamental step to highlight the gender gap. Finally, she requested that FAO begin planning to host an international conference for women in the fishery and aquaculture sectors.

These thoughts were also emphasized in the closing remarks of Audun Lem, Deputy-Director of FAO's Fisheries Division, who recalled that gender equality in the fisheries and aquaculture sector remains a work in progress, in part because of the very perception of gender as a domain of study in itself. Achieving gender equality also involves overcoming tensions that may arise between technologists and fisheries experts when confronted with social and gender specialists, while "in reality, we need to acknowledge the complementarity of these areas of work and the need for both disciplines". Mr Lem further stressed that the work that remains to be done cannot be carried out by women only and that men have an important role in the movement for gender equality, and "in fact, a responsibility to take on this work as allies". "Rethinking the power relationship between human beings and the traditional gender roles will release us from old and restrictive norms that limit men, women as well as those who define their identity otherwise", Mr Lem concluded.

This webinar was followed by a technical learning webinar, "Learning from experiences in implementing Gender Transformative Approaches in the fisheries and aquaculture sectors", organized on 16 March 2021 by FAO and the CGIAR GENDER Platform in the framework of the European Union-funded Rome-based Agencies Joint Programme on Gender Transformative Approaches for Food Security and Nutrition (JP GTA). The expert panel, composed of Cynthia McDougall (CGIAR GENDER Platform and WorldFish), Steven Cole (International Institute of Tropical Agriculture) and Afrina Choudhury (WorldFish), presented specific examples on how to apply and upscale Gender Transformative Approaches (GTAs) for wider impact and to achieve gender equality and food security. Presenting the JP GTA, Global Coordinator Hajnalka Petrics underscored the difference between GTAs and gender responsive or accommodating approaches that do not directly address the root causes of gender inequalities – in stark contrast to GTAs, which seek to understand, challenge and, ultimately, change discriminatory norms and practices to allow women to have the same opportunities as men. Steven Cole gave an example on how GTAs in a small-scale capture

11. FAO. 2020. *FAO Policy on Gender Equality 2020–2030*. www.fao.org/3/cb1583en/cb1583en.pdf

12. www.fao.org/3/ne472en/ne472en.pdf

13. <https://youtu.be/SCJTnJB3AJg>

14. www.fao.org/fileadmin/user_upload/faoweb/Fl/news/SpeakersBio.pdf

fisheries project in the western province of Zambia yielded significant results to advance gender equality. He underlined the importance of different behaviour-change communication strategies, such as tailor-made drama skits, to bring together a diverse stakeholder group and trigger critical reflection on gender norms as part of gender transformative interventions. Cole added that setting up a robust monitoring and evaluation process to assess changes over time in attitudes, norms and behaviour is key. Two years into the project, the use of GTAs resulted in a significant change in gender attitudes and women's participation in income-generating activities, from processing to trading of fish. Afrina Choudhury discussed technology transfer for women living in Bangladesh, referencing that various factors influence uptake and adoption. Appreciating the influence of these factors, gender transformative tools can spark critical reflection and dialogue at the individual, household and community levels around the norm-related barriers that can hinder women's ability to use and benefit from this technology. To conclude the webinar, Audun Lem emphasized the "strong commitment of the FAO Fisheries Division to achieve gender equality, and to embed Gender Transformative Approaches" in its technical work, as well as his "personal commitment to contribute to the gender transformative agenda".

Two major events in 2021 will also provide an opportunity to spotlight gender studies in aquaculture. The [Global Conference on Aquaculture +20](#) will include a thematic session that will address social and human dimensions in aquaculture, including gender, youth and decent employment; and the Eleventh Session of the COFI Sub-Committee on Aquaculture, which, for the first time, will have an agenda item on "Women and Aquaculture, challenges and opportunities for SDG 5". In the same vein, the forthcoming FAO [Guidelines on Sustainable Aquaculture](#) will include a practical thematic module on gender and youth, as well as case studies, to illustrate

the possible pathways towards inclusive and equitable aquaculture practices.

Conclusion

Now is the time to recognize that gender equality is key to achieving the SDGs and the sustainability of aquaculture and to put human, social and gender dimensions at the centre of the pursuit of these goals. This requires dedication to rethink our approach to the sector, and a commitment to shift from "ticking boxes" to working to realize the fundamental right of equality between human beings. While there is still a long way to go, the progress is encouraging, and FAO will continue the fight for gender equality.

SEE ALSO

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Fish market at the Ganvié boat landing, Lake Nokoué, Benin.

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Colleagues in Motion



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Teri Neer
Office Assistant
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Teri, a national from the United States of America, recently rejoined the Fisheries Division in August 2020. She completed her B.A. at Saint Mary's College, Notre Dame, Indiana and has an M.A. in Art History from Richmond, the American International University in London. She joined FAO in 2005, serving as an Operations Clerk for the Near East and North Africa Desk in the Emergency and Rehabilitation Division. From 2012 to 2015, she provided administrative support to the Marine and Inland Fisheries Branch as well as programme and budget support to the Fisheries and Aquaculture Resources Use and Conservation Division. After which she worked with the Sustainable Agriculture Programme Management Team (SP2). From November 2016 to August 2020, she was the Programme Assistant for the Inclusive Rural Transformation and Gender Equality Division.

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Svetlana Velmeskina
Office Assistant
Global & Regional Processes Team for Sustainable Aquaculture

Svetlana, a Russian national, has been seconded to the Global and Regional Processes Team of the Fisheries Division for five months as Office Assistant. Svetlana studied Accounting and Economics; Hospitality and Tourism Management in Russia. She spent first years of her career in tourism related fields. Svetlana moved to Thailand in 2011, where she worked as Accompanying Assistant at the tour operating company. She joined FAO in April 2016 as Temporary Assistant at the Plant Production and Protection Division, providing administrative and secretarial support. In 2018, she was assigned for six months to the Secretariat of the Rotterdam Convention, and later she joined the Aquaculture branch. In 2020, Svetlana moved to the Plant Production and Protection Division as Office Assistant.

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Victoria Chomo
Senior Fishery Officer
Global & Regional Processes Team for Sustainable Aquaculture

Victoria Chomo has a PhD in economics, (MSc and BSc in agricultural Economics) from North Carolina State University, USA. She was an economist in the U.S. Department of Agriculture (1991-1995) and the U.S. International Trade Commission (1999-2002) before joining the United Nations in 2002 (Beirut, UNESCWA; Geneva, UNCTAD). She moved to the FAO in 2011, namely the Fisheries and Aquaculture Department and to the Regional Office for Europe and Central Asia (FAOREU) in 2017 as Senior Fisheries and Aquaculture Officer and Secretary of two regional fisheries bodies. In May 2021 she will leave the sustainable aquaculture team of NFI to join the FAO Liaison Office with the European Union and Belgium (FAOLOB) in Brussels, mainly supporting FAO fisheries and aquaculture activities with the EU and its Member States. She will continue to serve as Secretary of the European Inland Fisheries and Aquaculture Advisory Commission (EIFAAC).

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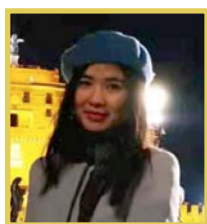
Elisabetta Martone

Fishery officer

National Planning and Development Support Team for Sustainable Aquaculture

Elisabetta Martone, an American-Italian national, holds a Ph.D. in Economics and Quantitative Methods, a Master's degree in Economics and Trade, and a Master's degree in Human Development and Food security from the University of Roma Tre, Italy. She has worked in both academic and consulting firm environments, gaining experience in the evaluation and assessment of government and international programmes. In FAO, since 2012 Elisabetta has assisted Member Countries to develop sound strategies, plans, programmes and guidelines for sustainable aquaculture development. Her work focused on promoting Aquaculture as a Business in terms of contributing to developing and disseminating training materials including on Aquaculture Governance and the User-Friendly Tool for Investment Decision Making in Aquaculture (UTIDA), and capacity building in Africa at both national and sub-regional level. In 2020, she was appointed Fishery Officer under the Project "Fisheries Co-management Capacity Development for Blue Communities: Sustainable Fisheries and Diverse Livelihoods" funded by Ministry of Oceans and Fisheries of the Republic of Korea.

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Minmin Lei

Associate Professional Officer

Global & Regional Processes Team for Sustainable Aquaculture

Minmini Lei, a Chinese national, holds a master's degree in Law from Beijing University of Chemical Technology and a bachelor's degree in English Literature from the same university. She joined FAO as an Associate Professional Officer in the Development Law Service of Legal Office in September 2018 and as a lawyer by training, she has been providing legal advice and technical assistance on development law issues of sustainable fisheries and aquaculture, including advising on regulatory elements States would want to look into when considering enacting or revising their fisheries and aquaculture legislation, planning and delivering capacity building programmes to enhance national stakeholders' capacity to conduct legal assessment, providing recommendation of legal options to Member Governments on regulated fisheries regimes, as well as providing training on international fisheries law. Before joining FAO, she worked in Chinese Academy of Fishery Sciences and was responsible for institutional and human resource management. In her secondment to Bureau of Fisheries, and Department of International Cooperation of Ministry of Agriculture and Rural Affairs, she covered a wide range of issues, including providing legal advice for bilateral negotiation with neighboring countries on fisheries management, drafting rules and regulations of fisheries and aquaculture and project management. During her two-month assignment with Aquaculture Global and Regional Processes Team, she will support the Global Conference on Aquaculture.

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Pierre Murekezi

Fishery Officer

National Planning and Development Support Team for Sustainable Aquaculture

Pierre Murekezi has been appointed to the position of Fisheries Officer (P2) and has joined the National Planning and Development Support Team (NFIAN). Pierre obtained a Bachelor's degree in Law from the National University of Rwanda and a Master's Degree in Rule of Law Development from Loyola University in Chicago, USA.

Before joining FAO, Pierre worked for the Ministry of Agriculture and Animal Resources in Rwanda as a Policy Officer, and in the Rwanda Office of the Ombudsman Prevention and Fight against Injustice Unit. He joined FAO in 2013 as a Legal Consultant for LEGN, managing agriculture policy analyses and drafting legal documents on institutional matters and international environmental law. Pierre joined the then Aquaculture Branch in 2016 and has since been working on field projects in Africa with a technical focus on aquaculture policy and aquaculture legislation formulation, assessment of opportunities and needs of national and regional aquaculture platforms for promotion of public-private partnerships (PPPs). He has also actively participated in the creation and institutionalization of the Aquaculture Network for Africa (ANAF). Pierre will primarily be responsible for the production of information materials on aquaculture".

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Publications



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Flagship Publications



FAO 2021 2021 COFI Declaration for Sustainable Fisheries and Aquaculture - Rome

The 2021 COFI Declaration for Sustainable Fisheries and Aquaculture aims to acknowledge the achievements of the fisheries and aquaculture in the past 25 years, and to gather collective momentum in tackling the challenges and opportunities to secure the long-term sustainability of the sector. We need to take action to ensure that our aquatic food systems are resilient and meet growing demand for nutritious, safe and affordable food while maintaining sustainable ecosystems, economies and societies that leave no one behind.

The PDF can be accessed directly at:
www.fao.org/3/cb3767en/cb3767en.pdf

The document card can be found here:
www.fao.org/documents/card/en/c/cb3767EN/

Sub-Committee on Aquaculture



FAO 2021 Report of the Tenth Session of the Sub-Committee on Aquaculture, Trondheim, Norway, 23-27 August 2019 - Rome

This document presents the adopted report of the tenth session of the Sub-Committee on Aquaculture of the FAO Committee on Fisheries (COFI), held in Trondheim, Norway from 23 to 27 August 2019. The Sub-Committee provides a forum for consultation and discussion on aquaculture-relevant topics, advises COFI on related technical and policy matters, and provides guidance for the future work.

Available in Arabic, Chinese, English, French, Spanish, Russian.

The PDF can be accessed directly at:
www.fao.org/3/ca7417t/CA7417T.pdf

The document card can be found here:
www.fao.org/publications/card/en/c/CA7417T

COVID-19 Policy briefs and resources

All FAO resources and publications regarding the novel Coronavirus (COVID-19) can be found here:

<http://www.fao.org/2019-ncov/en/>. Resources include policy briefs, technical publications, country profiles, as well as stories, multimedia and other information. Selected publications specifically relating to aquaculture are available at: www.fao.org/fishery/covid19/en/, and included here below:



FAO 2020 Summary of the impacts of the COVID-19 pandemic on the fisheries and aquaculture sector: Addendum to the State of World Fisheries and Aquaculture 2020 - Rome

The 2020 edition of The State of World Fisheries and Aquaculture was completed as the coronavirus disease (COVID-19) pandemic spread around the world. Therefore, the publication makes reference to, but does not address the impacts of, the pandemic on the sector. This addendum is intended to capture these rapidly evolving impacts, and provide a baseline for interventions and policy advice.

The PDF can be accessed directly at:
www.fao.org/3/ca9349en/CA9349EN.pdf

The document card can be found here:
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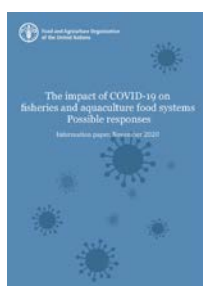


FAO 2020
The role of social protection in the recovery from COVID-19 impacts in fisheries and aquaculture – Rome

Food systems were severely hit by COVID-19 and the related restrictions to the movement of people and goods. In fisheries and aquaculture, the socio-economic effects of COVID-19 are manifold including changes in consumer demand, limited storage facilities, drop in fresh fish prices and stopping fishing operations. Many individuals working in the sector operate in the informal market with no coverage from labour market policies – not registered in mandatory social security, paid less than the legal minimum wage, without a written contract, or self-employed. These individuals include small-scale fishers, migrant, fish workers, ethnic minorities, crew members, harvesters, gleaners and vendors – especially women (FAO, 2020a; 2020b), who were the most affected by the pandemic. Social protection (SP) has been a key response that governments took to alleviate the socio-economic impacts of COVID-19 restrictions for fishery-dependent communities (FAO, 2020c). Countries with strong social protection systems in place were the most flexible to respond rapidly by adapting social protection programmes to the impact of COVID-19. Countries with weak social protection systems were less able to tailor programmes to attend the sector which is characterized by high informality. Several people who lost their employment were also left without any access to income support. The main type of social protection measures governments took to alleviate income losses in fisheries and aquaculture was temporary cash and in-kind transfers. The second most used type of programme was input subsidies.

The PDF can be accessed directly at:
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FAO 2020
The impact of COVID-19 on fisheries and aquaculture food systems. Possible responses – Information paper, November 2020 – Rome

The purpose of this information paper is to update information on the COVID-19 pandemic's impact on the fisheries and aquaculture sector and the measures taken, to inform on the ongoing impact on the fisheries and aquaculture food systems, and responses from seafood providers and governments to counteract the negative impacts on seafood chains.

The PDF can be accessed directly at:
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FAO 2020
Legal considerations in responses to COVID-19 to mitigate the risk of disruption to fisheries and aquaculture food systems – Rome

This brief identifies some of the areas that governments have intervened through emergency law to strengthen a resilient fisheries and aquaculture food supply chains and illustrates how these regulatory measures can be adopted by other countries thereby contribute to ensuring food security and economic development for all especially the indigenous peoples and women. As such, it contributes to FAO's Strategic Objectives on the eradication of hunger, food insecurity and malnutrition (SO2).

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The document card can be found here:
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FAO 2020
Fisheries and aquaculture in the Mediterranean and the Black Sea: A preliminary analysis of the impacts of the COVID-19 crisis – Rome

With a view to sharing information among its countries and facilitating a reflection on future responses, the GFCM has conducted a preliminary analysis of the impacts of this crisis on the fisheries and aquaculture sectors in the Mediterranean and the Black Sea region, which is contained in this brief. It clearly emerges from this analysis that the COVID-19 crisis has had major effects on fisheries and aquaculture production as well as on markets for fisheries and aquaculture products. The extent of the impacts and the measures taken have varied from country to country and are evolving constantly. The GFCM will continue to follow the evolution of this crisis to take steps to support the recovery of the fisheries and aquaculture sectors, with a special focus on the impacts on the livelihoods of fishers and aquaculture farmers.

The PDF can be accessed directly at:
www.fao.org/3/ca9090en/CA9090EN.pdf

The document card can be found here:
www.fao.org/documents/card/en/c/ca9090en



FAO 2020
The effect of COVID-19 on fisheries and aquaculture in Asia - Bangkok

On 10 April 2020, one month after the World Health Organization declared the spread of COVID-19 a pandemic, FAO published 'How is COVID-19 affecting the fisheries and aquaculture food systems' (FAO, 2020a). That policy brief, while global in scope, addressed the situation in some Asian countries. This paper provides an update, incorporating new data, developments and observations. During its writing, the pandemic was in full swing with no clear end in sight.

The PDF can be accessed directly at:
www.fao.org/3/ca9545en/CA9545EN.pdf

The document card can be found here:
www.fao.org/documents/card/en/c/ca9545en



FAO 2020
Legal considerations in responses to COVID-19 to mitigate the risk of disruption to fisheries and aquaculture food systems - Rome

This brief identifies some of the areas that governments have intervened through emergency law to strengthen a resilient fisheries and aquaculture food supply chains and illustrates how these regulatory measures can be adopted by other countries thereby contribute to ensuring food security and economic development for all especially the indigenous peoples and women. As such, it contributes to FAO's Strategic Objectives on the eradication of hunger, food insecurity and malnutrition (SO2).

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FAO 2021
Impact de la crise covid-19 sur les secteurs de la pêche et de l'aquaculture en Afrique du Nord - Tunis

Les présentes notes stratégiques ont pour objectif d'évaluer l'impact socio-économique de la pandémie de la covid-19 sur les secteurs de la pêche et de l'aquaculture dans quatre pays du Maghreb (Algérie, Maroc, Mauritanie et Tunisie) afin de proposer des orientations et des recommandations relatives aux mesures d'atténuation possibles pour ces pays. Elles ont été réalisées dans le cadre d'une enquête lancée par le bureau de l'Organisation des Nations Unies pour l'alimentation et l'agriculture pour l'Afrique du Nord, de mars à août 2020.

Impact de la crise covid-19 sur les secteurs de la pêche et de l'aquaculture en Algérie
www.fao.org/3/cb3001fr/cb3001fr.pdf

Impact de la crise covid-19 sur les secteurs de la pêche et de l'aquaculture en Mauritanie
www.fao.org/3/cb2998fr/cb2998fr.pdf

Impact de la crise covid-19 sur les secteurs de la pêche et de l'aquaculture au Maroc
www.fao.org/3/cb2997fr/cb2997fr.pdf

Impact de la crise covid-19 sur les secteurs de la pêche et de l'aquaculture en Tunisie
www.fao.org/3/cb3174fr/cb3174fr.pdf

Impact de la crise covid-19 sur les secteurs de la pêche et de l'aquaculture dans quatre pays du Maghreb
www.fao.org/3/cb2991fr/cb2991fr.pdf

Workshop reports



FAO 2021
Report of the Fifth Meeting of the Technical Advisory Committee of the Central Asian and Caucasus Regional Fisheries and Aquaculture Commission, Virtual Meeting, 23-24 November 2020.
пятое совещание технического консультативного комитета региональной комиссии по рыбному хозяйству и аквакультуре в центральной Азии и на Кавказе, видеоконференцсвязь, 23-24 ноября 2020 г. - Rome

The Fifth Meeting of the Technical Advisory Committee (TAC) was held virtually from 23rd to 24th November 2020. The meeting was attended by participants from three of the Central Asian and Caucasus Regional Fisheries and Aquaculture Commission (CACFish) member countries, namely, Azerbaijan, Kyrgyzstan, and Turkey. The following invited countries were present at the Meeting: Georgia, Kazakhstan, Turkmenistan, Ukraine and Uzbekistan. The meeting comprised 52 participants. The TAC discussed scientific recommendations on the following issues of relevance to CACFish: (i) Aquatic genetic resources; (ii) restocking and culture-based fisheries; and (iii) Post-harvest market measures, rules, and standards for safe, quality fish and fish products.

Bilingual in English and Russian.

The PDF can be accessed directly at:
www.fao.org/3/cb3258b/cb3258b.pdf

The document card can be found here:
www.fao.org/documents/card/en/c/cb3258b



FAO 2021
Report of the Regional Workshop for Asia and the Pacific Region on the Development of a Registry of Farmed Types of Aquatic Genetic Resources (Incorporating a review of strategic priorities for a Global Plan of Action), Virtual Workshop, 8-12 June 2020 - Rome

This report summarizes the proceedings and outcomes of the “Regional Workshop for Asia and the Pacific on the Development of a Global Information System for Farmed Types of Aquatic Genetic Resources (incorporating a review of strategic priorities for a Global Plan of Action)” held from 8 to 12 June 2020. The final wrap-up session was held on 22 June 2020. This workshop, supported financially by the Government of Germany, was the second in a series of regional workshops held to generate feedback on the Registry of Farmed Types of Aquatic Genetic Resources (Registry) being developed by FAO in response to the findings of the first report on The State of the World’s Aquatic Genetic Resources for Food and Agriculture (SoW-AqGR) prepared under the guidance of the Commission on Genetic Resources for Food and Agriculture (Commission) and launched by FAO in 2019. As requested by the Commission, the workshop also sought feedback on an outline of a Global Plan of Action for Aquatic Genetic Resources for Food and Agriculture (GPA). The workshop was originally planned to be held face to face in early 2020 but was eventually cancelled due to the challenges of the COVID-19 pandemic.

[The PDF can be accessed directly at:
www.fao.org/3/cb3412en/cb3412en.pdf](http://www.fao.org/3/cb3412en/cb3412en.pdf)

[The document card can be found here:
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FAO 2021
Report of the Regional Workshop for Europe and Central Asia on the Development of a Global Information System of Farmed Types of Aquatic Genetic Resources (Incorporating a Review of Strategic Priorities for a Global Plan of Action) - Virtual Workshop, 5-8 October 2020 - Rome

This report summarizes the proceedings and outcomes of the “Regional Workshop for Europe and Central Asia on the Development of a Global Information System for Farmed Types of Aquatic Genetic Resources (incorporating a review of strategic priorities for a Global Plan of Action)” held from 5 to 8 October 2020. The final wrap-up session was held on 15 October 2020. This workshop, supported financially by the Government of Germany, was the fourth in a series of regional workshops held to generate feedback on the Registry of Farmed Types of Aquatic Genetic Resources (Registry) being developed by FAO in response to the findings of the first report on The State of the World’s Aquatic Genetic Resources for Food and Agriculture (SoW-AqGR) prepared under the guidance of the Commission on Genetic Resources for Food and Agriculture (Commission) and launched by FAO in 2019. As requested by the Commission, the workshop also sought feedback on an outline of a Global Plan of Action for Aquatic Genetic Resources for Food and Agriculture (GPA), as requested by the Commission. The workshop was held online over a period of five days, with sessions lasting between 60 and 120 minutes. The workshop was attended by National Focal Points for Aquatic Genetic Resources from Europe and Central Asia, officials from ministries, governmental organizations, research institutions and by representatives of regional

aquaculture organizations. The objectives of the workshop were to promote standardized use of nomenclature and terminology in the description and categorization of aquatic genetic resources (AqGR), especially below the level of species (i.e. farmed types), to identify priority regional stakeholders who would benefit from and could contribute to an information system, such as the Registry, to evaluate the key elements of the prototype Registry using regionally relevant species and their farmed types and to review the strategic priorities and propose concrete activities under each of the four Priority Areas of the GPA.

[The PDF can be accessed directly at:
www.fao.org/3/cb2359en/CB2359EN.pdf](http://www.fao.org/3/cb2359en/CB2359EN.pdf)

[The document card can be found here:
www.fao.org/documents/card/en/c/cb2359en](http://www.fao.org/documents/card/en/c/cb2359en)



FAO 2021
Report of the African Regional Workshop on Development of a Global Information System for Farmed Types of Aquatic Genetic Resources (Incorporating a Review of Strategic Priorities for a Global Plan of Action), Addis Ababa, Ethiopia, 2-4 December 2019 - Rome

This workshop was the first of a series of regional meetings to generate feedback on the Registry of Farmed Types of Aquatic Genetic Resources (AqGR), being developed by FAO in response to a request from the Commission on Genetic Resources for Food and Agriculture (Commission). The workshop was supported by a grant from the Government of Germany and also included an activity seeking feedback on an outline of a Global Plan of Action for AqGR, also requested by the Commission. The objectives of the workshop were to: promote standardized use of nomenclature and terminology in the descriptions and categorization of AqGR, especially below the level of species (i.e. farmed types); to identify the priority regional stakeholders in an information system, specifically a Registry of Farmed Types of AqGR; to evaluate the key elements of the prototype Registry using regionally relevant species and their farmed types; review, for each of the four Priority Areas of the Global Plan of Action (GPA), the Strategic Priorities (SPs) and identifying possible activities under each SP; and identify potential indicators for the effective monitoring of AqGR within a future GPA.

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[The document card can be found here:
www.fao.org/documents/card/en/c/cb2343en](http://www.fao.org/documents/card/en/c/cb2343en)



FAO 2021
Report of the Round-Table Discussion: Moving Forward through Lessons Learned on Response Actions to Aquatic Animal Disease Emergencies, 16-18 December 2019 - Rome

This report presents the results of a Round-table discussion: moving forward through lessons learned on response actions to aquatic animal disease emergencies organized by the Food and Agriculture Organization of the United Nations (FAO) in collaboration with the Norwegian Agency for Development Cooperation (NORAD) under the auspices of the project GCP/

GLO/979/NOR: "Improving Biosecurity Governance and Legal Framework for Efficient and Sustainable Aquaculture Production" that was held from 16–18 December 2019 at the FAO Headquarters in Rome, Italy. The meeting was attended by 43 experts from 22 countries, representing governance authorities, intergovernmental organizations, academia, research institutions and the private sector. Twenty presentations were delivered, namely: (1) National Competent Authority: role and experiences; (2) Inter-governmental organization: role and activities/experiences related to investigating specific mass mortalities of aquatic animals; (3) Producer and research/academic sectors: role and activities/experiences related to investigating specific mass mortalities of aquatic animals and (4) Global Burden of Animal Diseases (GBAD). The meeting successfully achieved its objective of taking stock and sharing experiences and lessons learned which were used for generating recommendations for the further development and improvement of the draft FAO Decision-tree for dealing with aquatic animal mortality events and supporting guidance. The meeting generated an annotated table of contents for this decision-tree document with the following major sections, namely: Introduction; Phases in an Emergency; Elements of an Emergency Response (Preparedness Phase, Response Phase, Recovery Phase); Decision-tree for Mass Mortality Events; Conducting Field Investigation; Tools and Guidance; and Case Study Examples. It is expected that this document will be made available in 2021.

The PDF can be accessed directly at:
www.fao.org/3/cb2612en/CB2612EN.pdf

The document card can be found here:
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FAO Circulars

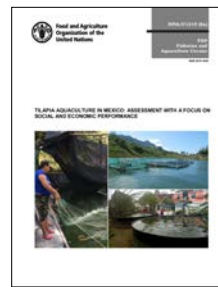


FAO 2021
Fish waste management - Assessment on potential production and utilization of fish silage in Bangladesh, Philippines and Thailand
Islam, J., Yap, E.E.S., Krongpong, L., Toppe, J. and Peñarubia, O.R. 2021. Fish waste management - An assessment of the potential production and utilization of fish silage in Bangladesh, Philippines and Thailand. FAO Fisheries and Aquaculture Circular No. 1216.

The production of fish silage using organic acid is a good example of the simple and inexpensive conversion processes which can be employed. Fish silage production uses minced by-products or minced whole fish unsuitable for human consumption as raw material, before adding a preservative to stabilize the mixture – usually an organic acid such as formic acid. The process breaks down protein into free amino acids and small-chain peptides which have nutritional and antimicrobial properties, therefore, the fish silage can be used as healthy feed and fertilizer. The feasibility studies on fish waste management in Bangladesh, Philippines and Thailand outline existing good practices on the utilization of by-products and fish waste. Furthermore, the insights provided on the potential production and utilization of fish silage in each country are promising in terms of increasing the productivity of the fisheries sector, reducing post-harvest waste, increasing economic value and improving environment sustainability.

The PDF can be accessed directly at:
www.fao.org/3/cb3694en/cb3694en.pdf

The document card can be found here:
www.fao.org/documents/card/en/c/cb3694en/



FAO 2021
Tilapia Aquaculture in Mexico - Assessment with a focus on social and economic performance
Martínez-Cordero, F.J., Delgado, T.S., Sánchez-Zazueta, E. and Cai, J. 2021. FAO Fisheries and Aquaculture Circular No. 1219.

Tilapias are the second-largest species group in Mexico's aquaculture; Mexico is the second-largest tilapia capture fisheries country; Mexico is the second-largest international market for tilapia products; and per capita tilapia consumption in Mexico is three times of the world average. This document assesses tilapia farming and the value chain in Mexico by examining tilapia farming systems and practices, dissecting the tilapia value chain, evaluating the sector's social and economic performance, discussing the impacts of proper governance and institutions on the sector development, and highlighting potentials, issues, constraints and challenges in the development of tilapia farming or aquaculture in general. The document ends with a brief discussion of the impacts of the ongoing coronavirus disease 2019 pandemic on the tilapia industry in the country.

The PDF can be accessed directly at:
www.fao.org/3/cb3290en/cb3290en.pdf

The document card can be found here:
www.fao.org/documents/card/en/c/cb3290en/



FAO 2020
Shrimp acute hepatopancreatic necrosis disease strategy manual
Tang, K.F.J.; Bondad-Reantaso, M.G.; Arthur, J.R.; MacKinnon, B.; Hao, B.; Alday-Sanz, V.; Liang, Y.; Dong, X.

The contents of this Shrimp acute hepatopancreatic necrosis disease strategy manual provides information and guidance relevant to the development of policies to respond to outbreaks of acute hepatopancreatic necrosis disease (AHPND) in farmed marine shrimp. The etiologic agents for AHPND are virulent strains of bacteria belonging to the genus *Vibrio* parahaemolyticus and related species, which harbor specific toxin genes. While these bacterial species are part of the normal microflora of the marine environment, they may cause substantial mortalities in whiteleg shrimp (*Penaeus vannamei*) and giant tiger prawn (*Penaeus monodon*) cultured in countries in Asia and the Americas. These strains of these *Vibrio* bacteria secrete a PirABvp binary toxin resulting in sloughing of tubule epithelial cells and dysfunctions of the hepatopancreas in the acute form; mortality can reach 100 percent in affected ponds. Chronic presentation of this disease involves secondary bacterial infection of hepatopancreas and running mortality over the culture cycle. Acute or chronic presentation would greatly depend on the culture conditions. This disease can be considered a toxicosis rather than an infection. Economic losses due to this disease have amounted to over USD 7 billion annually. Further outbreaks of AHPND, particularly in areas that are currently free of the disease, would be expected to experience similar devastating effects on local shrimp producers and the surrounding communities; and thus, there is an urgent need to develop a contingency plan to control and eradicate this disease. This manual includes information on: 1) the nature of AHPND: a brief review of current knowledge in disease

etiology, susceptible species and global distribution; 2) diagnosis of disease: a description of gross clinical signs and laboratory methods; 3) prevention and treatment: farm management, the use and development of antibiotics, bacteriophages, probiotics, disease-tolerant shrimp, shrimp immunity and vaccination; 4) epidemiology: AHPND's geographic distribution, genotype, persistence in the environment, reservoir hosts, modes of transmission, risk factors, and economic impacts; 5) principles of control and eradication: methods for containment, mitigation and eradication of AHPND, and trade and industry considerations; and 6) policy development and implementation: AHPND-specific objectives, options and strategies for eradication and control, education, capacity building, funding, and compensation..

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FAO handbooks, information papers and reports



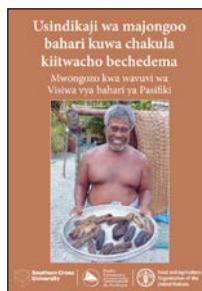
FAO 2020

Guía básica - Cambio climático pesca y acuicultura. Fortalecimiento de la capacidad de adaptación en el sector pesquero y acuícola chileno al cambio climático. Santiago de Chile, FAO
Barbieri, M.A., Aguilar-Manjarrez, J. y Lovatelli, A.

El cambio climático es un fenómeno a escala global, cuyos efectos - ya evidentes - afectan mares y océanos provocando migraciones de especies, incremento del nivel del mar, aumento de la frecuencia e intensidad de condiciones climáticas extremas y de los fenómenos de El Niño y La Niña, entre otros. Estos cambios están generando - y seguirán generando - consecuencias a nivel ambiental, social y económico. La pesca artesanal y la acuicultura de pequeña escala son actividades especialmente vulnerables a los efectos del cambio climático. De ahí que es necesario tomar medidas que contribuyan a mitigar los cambios y a acelerar la adaptación del sector al cambio climático. Esta guía busca contribuir a divulgar el cambio climático y entregar orientaciones sobre qué hacer ante los desafíos que esta situación nos impone, proporcionando ejemplos de medidas implementadas por la pesca artesanal y la acuicultura de pequeña escala para resolver los problemas y aprovechar las oportunidades generados por el cambio climático, así como para tomar conciencia de que nuestra participación es relevante. En suma, esta guía pretende ser un aliciente para que el sector pesquero artesanal y la acuicultura de pequeña escala de Chile implementen medidas de mitigación y de adaptación, así como de aprovechamiento de las oportunidades que genera el cambio climático, contribuyendo con el compromiso del país para alcanzar la meta de carbono neutralidad al año 2050.

[The PDF can be accessed directly at:](http://www.fao.org/3/cb1598es/cb1598es.pdf)
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FAO 2021

Usindikaji wa majongoo bahari kuwa chakula kiiwacho bechedema - Mwongozo kwa wavuvi wa Visiwa vya bahari ya Pasifiki. FAO, University of Southern Cross and the Pacific Community - Purcell, S.W. - Rome

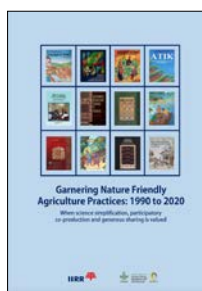
English – This manual was designed for sea cucumber fishers to better understand the steps to transform a fresh sea cucumbers into the dried form. Processing includes cutting, salting, cooking, smoking and sun-drying the sea cucumbers. The price given to fishers for dried sea cucumbers depends on the species they are selling, how big the individuals are and how well they have been processed. There are many different ways that sea cucumbers can be processed to obtain a good quality. This manual provides best practice methods that can be applied by fishers using locally available resources. The manual contains a section on responsible fishing and does not encourage increase fishing activities.

Swahili – Mwongozo huu umeundwa kwa ajili ya wavuvi wa majongoo bahari kuelewa vizuri hatua zote za kubadilisha majongoo bahari mabichi mpaka kuyakausha, ambayo huitwa 'bechedema'. Usindikaji unajumlisha kukata, kuweka chumvi, kupika, kukausha kwa moshi na kukausha majongoo bahari juani. Bei wanayopewa wavuvi wakiuza majongoo bahari yaliokaushwa inategemea aina ya jongoo wanayouza, ukubwa wa jongoo na umakini uliotumika wakati wa usindikaji. Kuna njia nyingi ambazo majongoo bahari yanaweza kusindikwa ili kupata ubora mzuri. Mwongozo huu unaelezea njia nzuri zaidi zinazoweza kutumiwa na wavuvi kwa kutumia rasilimali zinazopatikana kirahisi vijijini kwao. Mwongozo huo una sehemu inayoelezea juu ya uvuvi wa uwajibikaji na hauhamasishi kuongeza shughuli za uvuvi.

Available in Arabic and Swahili. Adapted from the original publication accessible at:
<https://coastfish.spc.int/en/home-pages/422-processing-sea-cucumbers>

[The PDF can be accessed directly at:](http://www.fao.org/3/i8576sw/i8576sw.pdf)
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FAO 2020

Garnering nature friendly agriculture practices: 1990 to 2020. When science simplification, participatory co production and generous sharing is valued. International Institute of Rural Reconstruction (IIRR) - Cavite

Field tested practices, methodologies and approaches to regenerating agriculture and associated ecosystems are featured in this compilation. Mostly experiences from across Asia are included, the compilation is based on publications generated through participatory writeshops, organised over thirty years featuring a wide range of stakeholders, disciplines and donors. Participatory approaches in resource management and farmer-centered approaches are prominently featured. A wide range of ecosystems are featured, coastal, drylands, mountains and lowlands in the presentations of options and approaches.

[The document card can be found here:](https://hdl.handle.net/10568/113673)
https://hdl.handle.net/10568/113673

Calendar of Events

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June 2021

Project closing seminar: "Strengthening the adaptive capacity to climate change in the fisheries and aquaculture sector of Chile" (GCP/CHI/039/SCF)

Santiago de Chile, Chile, 15 June 2021

Information: Jose.AguilarManjarrez@fao.org

Third Session of the Intergovernmental Technical Working Group on Aquatic Genetic Resources for Food and Agriculture

Rome, Italy, 01-03 June 2021

Information: ITWG-AQGR@fao.org

September 2021

Global Conference on Aquaculture Millennium +20

Shanghai, China, 22–27 September 2021

Information: GCA@fao.org



Raising the Visibility of Aquaculture Through FAO Stories

www.fao.org/home/stories-archive/en/



Fishing for change in the Emirati desert

Innovative Aquaculture Helps Sustainably Meet Growing Demands

To maintain momentum in aquaculture development, the United Arab Emirates Food and Water Security Office and FAO are working together to establish an enabling environment to unleash the potential of the sector to enhance food security and nutrition.

Read the FAO Story here:

www.fao.org/fao-stories/article/en/c/1371489/

See the photo album here:

www.flickr.com/photos/faoftheun/albums/72157718965022360

And see the article in FAN 62 here:

www.fao.org/3/cb1550en/cb1550en.pdf

A fresh start for prawn producers after extreme weather in Dominica

Building More Resilient Livelihoods in Islands Vulnerable to Climate Change

August 2020 marked a major milestone in prawn production in Dominica: the first batch of home-grown *Macrobrachium rosenbergii* (giant freshwater prawn) postlarvae was produced in a recently refurbished government hatchery, which had been devastated twice, first by Hurricane Erica in 2016 and then by Hurricane Maria in 2017.

Read the FAO Story here:

www.fao.org/fao-stories/article/en/c/1394703/

And see the article in FAN 62 here:

www.fao.org/3/cb1550en/cb1550en.pdf



Sustainable Aquaculture Fisheries Division

Food and Agriculture Organization of the United Nations
Viale delle Terme di Caracalla, 00153 Rome, Italy
E-mail: NFI-Inquiries@fao.org



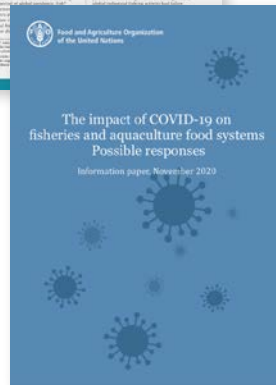
COVID-19 and its Impact on the Aquaculture Sector

The COVID-19 pandemic has triggered a public health crisis followed by an on-going economic crisis due to the measures taken by countries to contain the rate of infection, such as home confinement, travel bans and business closures.

Even though COVID-19 does not affect fish, nor is it caused by the consumption of fish, the fisheries and aquaculture sector is still subject to indirect impacts of the pandemic through changing consumer demands, market access or logistical problems related to transportation and border restrictions. This in turn will have a damaging effect on fishers and fish farmers' livelihoods, as well as on food security and nutrition for populations relying heavily on fish for animal protein and essential micronutrients. To assist in addressing impacts, the FAO Fisheries Division established a COVID-19 Task Team to coordinate initiatives in response to the pandemic and provide coordinated support to measures and interventions addressing the impact of COVID-19 on fisheries and aquaculture. One of the functions of this team is to communicate and share information.

In this edition of FAN, you can find policy briefs and other information on what actors can do to mitigate the impacts of COVID-19 on the sector. Over time, information is generated, and new insights become apparent.

All resources are available at www.fao.org/fishery/covid19/en



FAO Aquaculture News (FAN) is issued twice a year by the FAO Fisheries Division, Rome, Italy. It presents articles and views from the FAO aquaculture programme and discusses various aspects of aquaculture as seen from the perspective of both headquarters and the field programme. Articles are contributed by FAO staff from within and outside the Fisheries Division, from FAO regional offices and field

projects, by FAO consultants and, occasionally, by invitation from other sources. FAN is distributed free of charge to various institutions, scientists, planners and managers in member countries and has a current circulation of about 1 300 copies. It is also available on the FAO webpage: www.fao.org/fishery/publications/fan

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Graphic Designer: José Luis Castilla Civit

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